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HAVELI PROJECT

1935

VOLUME II

APPENDICES



(For official use only)

VOLUME II

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APPENDICES.

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APPENDIX A-I

DISCUSSION OF WATER SUPPLIES ON WHICH THE FORECAST OF IRRIGATION IN THE HAVELI PROJECT IS BASED.

1. The proposed distribution of supplies between Trimmu and Panjnad has been worked out in accordance with the recommendations of the Delhi Water Committee, appointed by the Government of India, to report on the "Distribution of the Waters of the Indus and its Tributaries."

2. Statements I and II show the supplies available for use at Trimmu based on the last 12 years' discharges. The record of river discharges in the Punjab is maintained by the Discharge division and the necessary figures were supplied by it.

3. Statement I shows the supplies available from the 16th of October to the 15th of April for the years 1921—1934 inclusive. Columns 2, 3, 6, 7, 10, 11, 14, 15, 18, 19, 22, 23, 26 and 27, have been supplied by the Discharge division. The remaining columns show the calculated share of the Panjnad and the proposed Haveli canals, based on the recommendations of the Committee and are explained below:—

(a) From the 1st of November to the 15th of April, regeneration above Trimmu has been allocated to the Haveli canals, and regeneration below Trimmu to the Panjnad canals, up to the limit of their authorised withdrawals. A perusal of the statement will show that the advantage lies with the Panjnad and it is likely to increase, as the Haveli project develops because of a probable increase in the regeneration water below Trimmu.

(b) From the 16th of October to the 31st of October, the Haveli and the Panjnad perennial canals have the first right, up to their authorised capacities of 2,750 and 1,500 cusecs. The water in excess of the combined discharge of 4,250 cusecs has been divided between the Haveli and the Panjnad in the proportion of 5,000 and 6,500.

(c) From the 1st to the 10th of December, it is proposed to withdraw the available water up to the maximum authorised limit, but the monthly mean is not allowed to exceed 990 cusecs, by taking less water from the 11th to the 31st December. In Appendix D-I, it has been shown that the water allowed in December, January and February will just suffice to mature the rabi crops with the aid of existing wells.

(d) From the 1st to the 15th April, for purposes of the forecast, supply taken as available for the Haveli has been limited to 2,750 cusecs. The Delhi Committee has recommended that water may be given to the non-perennial canals in this period, only after the Sukkur demands have been fully met. At present it is not possible to know, with any certainty, the extent of the surplus water that will be available.

4. Statement II shows the water supplies, available for utilization at Trimmu, from 16th April to the 15th of October, based on the record of the years 1922—34 inclusive.

(a) From the 16th to the 30th April, in accordance with the recommendations of the Committee the share of the Haveli project has been taken as 7,750 cusecs. The storage capacity of the Panjnad pond will ensure sufficient supplies to the Panjnad canals. Further, in April the demand for water never reaches capacity.

(b) From the 1st to the 15th of October, the available supply has been divided between the Haveli and the Panjnad, in the proportions of 7,750 and 8,000 cusecs. Both ponds will be able to store supplies, so as to tide over an occasional shortage, but no credit has been taken for such pondage water.

5. Statement III shows the distribution of the available supply between the Haveli perennial and non-perennial canals. In the month of October, the supply will be divided approximately in the ratio of 2,750 and 5,000 cusecs. From the 1st of November to the 15th of April all supplies are reserved for perennial canals. For the remainder of the year there are ample supplies for both.

SUPPLIES AVAILABLE FOR UTILIZATION AT TRIMMÚ FOR HAVELI PROJECT

Year.	OCTOBER 16TH TO 31ST.				NOVEMBER.				DECEMBER.			
	From Discharge Division records.		In accordance with Delhi Committee.		From Discharge Division records.		In accordance with Delhi Committee.		From Discharge Division records.		In accordance with Delhi Committee.	
	Discharge of Chenab at Trimmú.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmú.	Discharge of Chenab at Trimmú.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmú.	Discharge of Chenab at Trimmú.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmú.
1	2	3	4	5	6	7	8	9	10	11	12	13
1921-22 ..	9,418	10,878	5,246	5,632	2,807	5,100	$\frac{1,350}{2,534}$	2,475	3,218	4,063	$\frac{1,500}{2,508}$	$\frac{2,175}{2,508}$
1922-23 ..	11,724	10,404	4,935	5,460	3,220	5,688	$\frac{1,350}{3,213}$	2,475	3,111	1,475	$\frac{1,500}{2,000}$	2,475
1923-24 ..	3,970	5,372	2,134	3,238	2,975	3,027	$\frac{1,152}{1,152}$	2,475	2,164	3,500	$\frac{1,336}{1,336}$	2,164
1924-25 ..	2,722	8,608	5,886	2,722	2,200	4,714	$\frac{1,350}{2,514}$	*2,475	3,553	4,697	$\frac{1,500}{2,222}$	2,475
1925-26 ..	3,265	6,605	3,340	3,265	3,241	5,184	$\frac{1,350}{2,709}$	2,475	1,917	2,034	$\frac{1,077}{1,077}$	1,017
1926-27 ..	7,146	13,610	6,464	7,146	2,901	6,146	$\frac{1,350}{3,371}$	2,475	1,930	3,583	$\frac{1,500}{1,044}$	1,930
1927-28 ..	3,228	6,541	3,313	3,228	2,212	3,908	$\frac{1,350}{1,786}$	*2,475	2,061	2,925	$\frac{864}{864}$	2,061
1928-29 ..	4,242	8,976	1,734	4,242	2,486	3,163	$\frac{689}{698}$	2,475	9,343	10,472	$\frac{1,500}{7,967}$	2,475
1929-30 ..	12,211	19,049	8,000	7,750	6,715	11,885	$\frac{1,350}{9,410}$	2,475	3,917	6,237	$\frac{1,500}{3,702}$	2,475
1930-31 ..	13,195	8,852	4,101	4,751	9,626	8,013	$\frac{1,350}{5,538}$	2,475	1,764	3,816	$\frac{1,500}{2,052}$	1,764
1931-32 ..	9,161	12,525	6,177	6,348	2,752	5,209	$\frac{1,350}{2,824}$	2,475	1,926	2,654	$\frac{728}{728}$	1,926
1932-33 ..	2,823	3,517	797	2,750	1,775	3,280	$\frac{1,350}{1,505}$	*2,475	1,228	2,061	$\frac{833}{833}$	1,228
1933-34 ..	16,914	19,550	8,000	7,750	5,312	8,675	$\frac{1,350}{6,200}$	2,475	3,618	5,892	$\frac{1,500}{2,857}$	2,475
Average ..	..	..	4,856	4,045	..	..	$\frac{1,284}{3,410}$	2,475	..	..	$\frac{1,222}{2,295}$	1,212

Note.—In columns 8, 12, 16, 20, 24 and 28 the numerator shows the share of Panjnad in the perennial supply while the denominator gives the storage of water in Trimmú pond between the levels required to feed the canal in kharif and rabi, viz., in practice, available for the period 11th to 31st December.

APPENDIX A-I STATEMENT I

DURING WINTER (DAILY AVERAGE IN CUSECS.)

JANUARY.				FEBRUARY.				MARCH.				APRIL 1ST TO 15TH.			
From Discharge Division records.		In accordance with Delhi Committee.		From Discharge Division records.		In accordance with Delhi Committee.		From Discharge Division records.		In accordance with Delhi Committee.		From Discharge Division records.		In accordance with Delhi Committee.	
Discharge of Chenab at Trimmu.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chenab at Trimmu.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chenab at Trimmu.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chenab at Trimmu.	Chenab component at Panjnad.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
8,563	10,185	$\frac{750}{9,235}$	990	8,613	9,004	$\frac{1,000}{8,014}$	990	12,668	10,193	$\frac{1,500}{7,443}$	2,750	26,523	18,391	$\frac{1,500}{8,000}$	2,750
5,660	5,013	$\frac{750}{4,033}$	990	22,087	16,519	$\frac{1,000}{15,510}$	990	34,763	24,132	$\frac{1,500}{8,000}$	2,750	48,090	32,633	$\frac{1,500}{8,000}$	2,750
1,457	2,631	$\frac{750}{1,641}$	990	13,226	13,352	$\frac{1,000}{12,362}$	990	21,748	11,303	$\frac{1,500}{8,000}$	2,750	28,000	16,169	$\frac{1,500}{8,000}$	2,750
4,170	5,230	$\frac{750}{4,246}$	990	3,818	4,212	$\frac{1,000}{3,242}$	990	2,837	3,714	$\frac{964}{964}$	2,750	8,250	5,617	$\frac{1,500}{2,897}$	2,750
1,462	2,627	$\frac{750}{1,037}$	990	1,338	2,051	$\frac{1,000}{1,071}$	990	13,464	10,037	$\frac{1,500}{7,307}$	2,750	12,864	9,120	$\frac{1,500}{6,380}$	2,750
1,550	2,602	$\frac{750}{1,612}$	990	1,734	2,596	$\frac{1,000}{1,510}$	990	2,084	2,666	$\frac{582}{582}$	2,084	6,160	5,178	$\frac{1,500}{2,428}$	2,750
1,409	2,436	$\frac{750}{1,416}$	990	8,315	10,631	$\frac{1,000}{9,611}$	990	11,448	14,123	$\frac{1,500}{8,000}$	2,750	19,252	20,517	$\frac{1,500}{8,000}$	2,750
3,911	5,909	$\frac{750}{4,079}$	990	7,830	10,610	$\frac{1,000}{9,610}$	990	11,642	10,598	$\frac{1,500}{7,846}$	2,750	16,844	19,585	$\frac{1,500}{8,000}$	2,750
8,042	11,809	$\frac{750}{10,970}$	990	10,227	15,568	$\frac{1,000}{14,576}$	990	30,010	20,026	$\frac{1,500}{8,000}$	2,750	61,119	85,348	$\frac{1,500}{8,000}$	2,750
4,201	3,302	$\frac{750}{2,372}$	990	4,439	5,941	$\frac{1,000}{4,461}$	990	11,919	8,541	$\frac{1,500}{5,794}$	2,750	23,689	17,641	$\frac{1,500}{8,100}$	2,750
3,010	3,775	$\frac{750}{2,785}$	990	2,746	4,174	$\frac{1,000}{3,181}$	990	7,812	6,136	$\frac{1,500}{3,386}$	2,750	14,753	13,185	$\frac{1,500}{8,000}$	2,750
1,211	2,250	$\frac{750}{1,269}$	990	936	1,994	$\frac{978}{978}$	936	10,665	6,083	$\frac{1,500}{3,333}$	2,750	20,396	10,560	$\frac{1,500}{5,000}$	2,750
2,850	4,647	$\frac{750}{3,657}$	990	1,671	2,876	$\frac{1,000}{1,886}$	990	3,276	3,765	$\frac{1,015}{1,015}$	2,750	6,001	3,821	$\frac{1,081}{1,081}$	2,750
..	..	$\frac{750}{3,495}$	990	..	..	$\frac{997}{6,631}$	990	..	..	$\frac{1,351}{5,330}$	2,090	..	..	$\frac{1,468}{6,522}$	2,750

actual supply available in the Haveli canals to draw off the augmented maximum even in years, when it does not appear to be available in the river at Trimmu, = 21420 cusecs-days. Balance available = $990 \times 31 - 21420 = 9270$ cusecs-days, which is equivalent to a mean daily supply of 441 cusecs.

APPENDIX A-I STATEMENT II

SUPPLIES AVAILABLE FOR UTILIZATION AT TRIMMU FOR HAVELI PROJECT DURING SUMMER (DAILY AVERAGE IN CUSFCS).

	MAY.						JUNE.						JULY.						AUGUST.						SEPTEMBER.						OCTOBER 1st TO 15th.					
	From Discharge Division records.			In accordance with Delhi Committee.			From Discharge Division records.			In accordance with Delhi Committee.			From Discharge Division records.			In accordance with Delhi Committee.			From Discharge Division records.			In accordance with Delhi Committee.			From Discharge Division records.			In accordance with Delhi Committee.			From Discharge Division records.			In accordance with Delhi Committee.		
	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.	Discharge of Chennai at Trimmu.	Share of Bahawalpur at Panjnad.	Share of Haveli project at Trimmu.						
1922-23	27,212	21,700	8,000	7,750	63,286	12,757	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1923-24	53,915	13,763	8,000	7,750	69,133	17,038	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1924-25	10,201	27,134	8,000	7,750	30,420	30,801	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1925-26	22,777	11,743	8,000	7,750	11,767	33,431	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1926-27	16,121	21,912	8,000	7,750	51,015	16,456	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1927-28	11,408	10,216	8,000	7,750	34,015	28,159	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1928-29	77,017	52,730	8,000	7,750	60,098	67,371	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1929-30	12,097	37,326	8,000	7,750	35,187	36,575	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1930-31	77,729	71,159	8,000	7,750	86,320	89,746	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1931-32	18,882	25,913	8,000	7,750	47,028	40,174	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1932-33	22,004	17,591	8,000	7,750	25,851	19,895	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
1933-34	33,244	27,523	8,000	7,750	17,505	31,000	8,000	8,000	7,750	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750	8,000	8,000	7,750		
Average	..	..	7,207	7,750	..	..	..	..	7,750	7,750	8,000	7,750	..	..	8,000	7,750	8,000	7,750	..	..	8,000	7,750	8,000	7,750	..	..	8,000	7,750	8,000	7,750	8,000	7,750	8,000	7,750

APPENDIX A-I, STATEMENT III

STATEMENT SHOWING THE SHARE OF PERENNIAL AND NON-PERENNIAL CANALS.

Month.	Total daily average supply available at Trimmu. (cusecs.)	Share of perennial (cusecs.)	Share of non-perennial (cusecs.)	DISCHARGE AVAILABLE AT DISTRIBUTARY HEADS (CUSECS)				REMARKS.
				Perennial.		Non-perennial.		
				% acres. gross area.	% acres C.C.A.	% acres gross area.	% acres C.C.A.	
1	2	3	4	5	6	7	8	9
April 16th—30th ..	7,750	2,750	5,000	3.3	4.0	4.8	6.0	Total proposed perennial culturable commanded area (C.C.A) Acres. 574,213
May ..	7,750	2,750	5,000	..	..	..	..	Gross area .. 694,278
June ..	7,750	2,750	5,000	..	..	..	..	Total non-perennial C. C. A. (Left bank) .. 390,968
July ..	7,750	2,750	5,000	..	..	..	..	Gross area .. 451,155
August ..	7,750	2,750	5,000	..	..	..	..	Total non-perennial C. C. A. (Right bank) .. 307,023
September ..	7,750	2,750	5,000	..	..	..	..	Gross area .. 411,394
October 1st—15th ..	6,818	2,420	4,398	2.9	3.5	4.2	5.2	Total C. C. A. non-perennial (Left and right banks) .. 608,891
October 16th—31st ..	4,945	1,935	3,010	2.3	2.7	2.9	3.6	Gross area do. .. 862,549
November ..	2,475	2,475	..	3.0	3.5	..	..	Note. For working out discharge at distributary head, 1/6th should be deducted from discharge available at Trimmu headworks.
December 1st—10th ..	2,142	2,142*	..	2.6	3.1	..	..
December 11th—31st ..	441	441*	..	0.5	0.6	..	..
January ..	990	990	..	1.2	1.4	..	..
February ..	986	986	..	1.2	1.4	..	..
March ..	2,699	2,699	..	3.2	3.5	..	..
April 1st—15th ..	2,750	2,750	..	3.3	4.0	..	..

* See Para. 3 (c) page 1.

APPENDIX A-II

DISCUSSION OF PROBABLE WATER SUPPLIES IN THE RAVI RIVER AT BALLOKI, AVAILABLE FOR UTILIZATION IN THE PAKPATTAN PERENNIAL CANAL AND THE BURALA BRANCH EXTENSION OF THE LOWER CHENAB CANAL, BASED ON THE DISCHARGE DIVISION RECORDS

1. Columns 3, 5, 7, etc. of statement I show the discharge, available at Balloki, subject to a capacity of 1,070 cusecs, year by year for 12 years, and column 26 gives the average of these 12 years. The figures in column 26 form the forecast of probable supplies in future years. In the winter months the mean supplies required are always less than canal capacity. The reasons for fixing a 1,070 cusecs capacity are two-fold:—

(a) The supplies in the months of December to February are only sufficient to justify a capacity of 1,070 cusecs.

(b) 1,070 cusecs capacity is just sufficient for the needs of Pakpattan perennial and Burala Branch Extension.

2. 700 cusecs capacity is reserved for the Pakpattan perennial canal and will be taken out of the river into the Lower Bari Doab canal at Balloki and let out of the Lower Bari Doab canal into the Montgomery-Pakpattan Link and so into the Pakpattan canal. The Lower Bari Doab canal officers are satisfied that the canal can carry this 700 cusecs in addition to its own full demand.

3. The remaining 370 cusecs capacity is reserved in the interests of Burala Branch Extension, but can only be used indirectly for it. In the months of river shortage, the Lower Bari Doab canal is fed by Chenab water brought to Balloki in the Upper Chenab canal. Supplies sent down in future for the Lower Bari Doab canal will be less by the amount of winter water given to the Burala Branch Extension via the Lower Chenab canal, and the equivalent water available at Balloki will be utilised in the Lower Bari Doab canal.

4. Statement II shows the division of water between the Pakpattan perennial and the Burala Branch Extension for the various months in the year, based on the proportion of 700 to 370 cusecs. The equivalent of 370 cusecs water, at present, comes down the Upper Chenab canal for the Lower Bari Doab canal requirements. This will be switched down the Lower Chenab canal for the Burala Branch Extension. In the summer, April to September, the Burala Branch Extension already gets its requirements from the Chenab and the whole supply from Balloki would be available for the Pakpattan Link.

5. The distance from Marala, the headworks of the Upper Chenab canal, to Balloki along the Upper Chenab canal is 120 miles, which is equal to the distance from Marala to the head of Burala Branch along the river up to Khanki and then along the Lower Chenab canal. Hence the question of deduction for absorption upstream of the Burala Branch does not arise. A deduction of 10% for absorption in the Burala Branch itself has been made.

6. The actual absorption in the Lower Bari Doab canal from Balloki to Montgomery, as obtained from the Lower Bari Doab canal records is 4%. A total deduction of 10% for absorption has, however, been made from the Pakpattan perennial supplies.

APPENDIX A-II STATEMENT I

AVAILABLE SUPPLIES FROM THE RAVI RIVER AT BALLOKI FOR UTILIZATION IN BURALA BRANCH EXTENSION AND MONTGOMERY-PAKATTAN LINK AFTER THE CONSTRUCTION OF THE HAVELI PROJECT (LIMITED BY 1070 CUSECS CAPACITY)

Year	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34
	at	at	at	at	at	at	at	at	at	at	at	at
	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.	Available for utilization.
	1	2	3	4	5	6	7	8	9	10	11	12
Septem-ber	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
October	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
November	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
December	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
January	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
February	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
March	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
April	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
May	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30
June	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30	1-10 11-20 21-30

* Means supplies in excess of surplus supplies from Upper Chenab canal tail over and above the Lower Bari Doab canal requirements, passed down to the Sidhni headworks. These supplies have not been taken into account in the financial forecast of the project.

APPENDIX A—II STATEMENT II

DISTRIBUTION OF AVAILABLE SUPPLY FROM THE RAVI AT BALLOKI INTO PAK-
PATTAN PERENNIAL AND BURALA BRANCH EXTENSION.

PERIOD.	Average supply available at Balloki (from col. 20 of statement I).	SHARE OF BURALA BRANCH EXTENSION (capacity 370 cusecs)			SHARE OF PAKPATTAN PERENNIAL (capacity 700 cusecs).		
		At head of Burala branch.	Deduct absorption in branch 10%.	Available for utiliza- tion at distributory heads.	At Balloki head.	Deduct absorption at 10%.	Available for utiliza- tion at distributory heads.
1	2	3	4	5	6	7	8
	cusecs.	cusecs.	cusecs.	cusecs.	cusecs.	cusecs.	cusecs.
1-10 ..	1,070	370	37	333	700	70	630
September 11-20 ..	1,070	370	37	333	700	70	630
21-30 ..	1,070	370	37	333	700	70	630
1-10 ..	1,046	362	36	326	684	68	616
October 11-15 ..	1,013	350	35	315	663	66	597
16-20 ..	953	329	33	296	624	62	562
21-31 ..	840	290	29	261	550	55	495
1-10 ..	748	259	26	233	489	49	440
November 11-20 ..	711	246	24	222	465	46	419
21-30 ..	716	247	25	222	469	47	422
1-10 ..	814	281	28	253	533	53	480
December 11-20 ..	770	266	27	239	504	50	454
21-31 ..	728	252	25	227	470	47	423
1-10 ..	723	250	25	225	473	47	426
January 11-20 ..	913	323	32	291	610	61	549
21-31 ..	916	324	32	292	612	61	551
1-10 ..	807	300	30	270	567	56	511
February 11-20 ..	800	270	28	251	527	53	474
21-28/29 ..	623	285	29	256	538	54	484
1-10 ..	890	308	31	277	562	56	506
March 11-20 ..	847	293	29	264	554	55	499
21-31 ..	822	284	28	256	538	54	484
1-10 ..	834	From April to September the Burala Branch Extension is already taking its supplies from the Chenab. The Punjab reserves the right to enlarge the Montgomery-Pakpattan Link, so as to utilize all Ravi water at present being used in the Sidhnai. The forecast is based on 700 cusecs, although the water from April to June is in excess of this figure.			833	83	750
April 11-15 ..	847				853	85	768
16-20 ..	734				754	75	679
21-30 ..	891				833	83	750
1-10 ..	848				833	83	750
11-20 ..	758				758	76	682
21-31 ..	759				759	76	683
1-10 ..	989				833	83	750
11-20 ..	965				833	83	750
21-30 ..	1,024				833	83	750

EXPENDITURE ESTIMATES

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APPENDIX B-I

EXPLANATORY NOTES ON EXPENDITURE ESTIMATES.

UNIT No. I—TRIMMU HEADWORKS.

1. The main items that comprise the Trimmu headworks estimate are :—

(i) *B-Land.*

The areas of land have been assessed in accordance with areas under the Panjnad pond. The allowance, however, for cost is 19.2 lacs as against 6.98 lacs at Panjnad. Land was cheap at Panjnad, because much of it was in Bahawalpur territory.

(ii) *C-Works.*

Fully detailed designs have been drawn out for the barrage and head regulators of the canals, and detailed estimates have been computed from detailed drawings for the 18 various items that go to make the whole barrage as given in statement I. Cost of gates and gearing as given below has been taken from information supplied by Superintendent, Central Workshops, Amritsar, vide his D. O. No. 32, dated the 2nd May 1935, with slight modifications in the charges for erection :—

	Rs.
(a) Undersluices 30 ft. spans, double gates, 18 ft. high, 16 No. @ Rs. 26,000 each	4,16,000
(b) Weir 60 ft. spans, single gates, 12 ft. high, 51 No. @ Rs. 25,000 each ..	13,50,000
(c) Main canal regulator, 20 ft. spans, radial gates, 10 ft. high, 9 No. @ Rs. 13,000 each	1,17,000
(d) Shorkot Branch regulator, 20 ft. span, radial gate, 6 ft. high, 1 No. @ Rs. 11,000	11,000
(e) Rangpur canal regulator 20 ft. spans, radial gates, 7 ft. high, 5 No. @ Rs. 11,600 each	58,000
(f) Carriage charges to site	90,000
(g) Erection charges including painting	2,50,000
Total cost at site	22,92,000
(Say)	23,00,000

The quantities of earthwork in the right and left marginal bunds, which are under C-Works have been calculated in detail from longitudinal sections.

(iii) *R-Railways.*

The estimate is Rs. 11.49 lacs and compares with Rs. 16.7 lacs for Panjnad. Panjnad, however, has a 21 miles canal railway to connect up with the North Western railway. The length of railway here will be about 8 miles. The length of sidings, of course, in both cases will be about the same. We have sufficient broad-gauge rails on stock, surplus from Sutlej Valley canals, to meet the full Haveli requirements.

(iv) *Special Tools and Plant.*

Estimate is Rs. 10.76 lacs as compared with Rs. 8.88 lacs for Panjnad. Each item in the list has been carefully and fully considered in consultation with a mechanical engineer with past experience of Sutlej Valley construction.

(v) *Establishment.*

Estimate is Rs. 17.77 lacs. Establishment has been calculated at 7½% on works as against 6½% on the Sutlej Valley. 6½% was found to be insufficient and the cost of establishment exceeded in the revised estimate. The percentage allowance is in accordance with Sutlej Valley experience of probable costs and it has also been compared with probable establishment costs based on the detailed statement of establishment required; vide Appendix F—II.

2. The total cost of Trimmu barrage and headworks is Rs. 230 lacs as compared with Rs. 189 lacs actual cost of Panjnad. The estimate has been calculated liberally in the following respects :—

(a) An excess waterway of 14 bays of 60 feet span has been allowed above what will probably be actually necessary.

(b) The rates are liberal. Analyses of rates are given in Appendix B—III. This does not mean, however, that unduly liberal rates will be paid to contractors. The schedule of rates to be issued to local construction officers will be a revised and lower schedule.

3. It is advisable to have a liberal estimate for river works, because unusually heavy floods, during construction period, may cause appreciable damage. If there is no money as reserve in the estimate, it would mean a revised project estimate, and such revisions sap confidence in the Province concerned.

UNIT No. 2—ABDUL HAKIM HEADWORKS.

4. The main items that comprise Abdul Hakim barrage and headworks on the Ravi river are:—

(i) *B—Land.*

Area of land required will be small as the river keeps to its own defined channels and will not spill over the surrounding country.

(ii) *C—Works.*

Fully detailed designs have been drawn out for the barrage and head regulators of canals and detailed estimates have been computed from detailed drawings for the 17 various items (*vide* statement II) that comprise the whole barrage.

Cost of gates and gearing, as detailed below, has been taken from information supplied by Superintendent, Central Workshops, Amritsar, *vide* his letter No. 70, dated the 18th February 1932, after slight modification:—

	Rs.
(a) Undersluices, 4 spans of 30 ft., double gates, 15 ft. high, @ Rs. 22,000 per span	88,000
(b) Weir, 11 spans of 30 ft., single gates, 10 ft. high, @ Rs. 16,000 per span	1,76,000
(c) Sidhulai canal regulator, 3 spans of 20 ft., radial gates, 9.3 ft. high, @ Rs. 12,000 per span	36,000
(d) Abdul Hakim canal regulator, 1 span of 15 ft., radial gates, 7.1 ft. high, @ Rs. 8,000	8,000
(e) Multan Branch regulator, 4 spans of 20 ft., radial gates, 8.3 ft. high, @ Rs. 11,000, each	44,000
(f) Fazil Shah canal regulator, 1 span of 15 ft. @ Rs. 5,000	5,000
(g) Koranga canal regulator, 1 span of 15 ft. @ Rs. 5,000	5,000
(h) Tail inlet, 14 spans of 7.5 ft., radial gates, 8 ft. high, @ Rs. 4,000 per span	56,000
Total cost F. O. R. Amritsar	4,18,000
(i) Carriage charges to site	11,000
(j) Erection charges	26,000
Total cost at sites	4,55,000
Contingencies and unforeseen—lumpsum	59,000
Total	5,14,000

(iii) *R—Railways.*

The cost of the railways is small, because the site of work is within 2 miles of a North Western railway station.

5. Triumun headworks estimate is Rs. 230 lacs for a flood discharge of 6½ lacs cusecs. On the basis of cost per cusec discharge, Abdul Hakim with a flood discharge of 82,000 cusecs should cost about 20 lacs as against an estimated cost of 39 lacs. The smaller barrages must cost somewhat more per cusec discharge, because such items as head regulators of canals, etc., remain the same in both cases.

UNITS No. 3 & 4—LEFT AND RIGHT BANK CANALS.

6. The principal items comprising the estimate for main canal and branches are B—Land, E—Falls, G—Bridges, L—Earthwork, and L—(2) Core Walls.

(i) *B—Land.*

The areas of land required for each of the new canals have been computed in detail.

(ii) *E—Falls and G—Bridges.*

Detailed type designs were drawn for the following works:—

Regulating fall and village road and foot bridge, ordinary village road bridge for varying full supply depths, bed widths and spans. From these type designs, detailed estimates have been computed for a pier, an abutment, etc., etc., and so estimates for each and every bridge and combined bridge and fall have been obtained. Statements III (a) to (d) show detailed estimated quantities for masonry works for the various canals.

APP. B-I

(iii) *L—Earthwork.*

Detailed quantities for earthwork are based on actual longitudinal sections, and have been calculated at every 1,000 feet. Length of main canals and branches is shown in Statement IV.

(iv) *L*-(2) Core Walls.

From Shorkot Road railway station to near Abdul Hakim on the Ravi, the Main canal is in high embankment, and it will be extremely difficult to maintain an earthen channel against so big a head of water. It was, therefore, decided to construct a reinforced masonry wall, one-brick thick, in the centre of the banks of the canal. The quantities were calculated in detail.

(v) *Distributaries.*

The estimate for distributaries is based on the areas of land to be served. The rate applied is per acre, and is based on Punjab experience of the cost of such works elsewhere.

(vi) *Drainage and Protection Works.*

Quantities of earthwork have been obtained from longitudinal sections of the more principal drains; in some items, the quantities are based on average sectional areas required for drains.

Estimates for bridges over the drains are based on quantities obtained from a type design.

Land areas were calculated separately for Crown waste and proprietary areas; according to the widths of drains.

(iii) *Watercourses.*

The estimate is based on areas, to be provided with watercourses, and a rate per acre, which has proved suitable in the past.

(viii) *Special Tools and Plant.*

Allowance has been made for excavators required for the main canal. Second-hand machines left over from the Sutlej Valley project will be utilized on the main canal only upstream of the core-wall reach.

(ix) *Establishment.*

This has been calculated on a percentage basis. On the Sutlej Valley project 15 % was allowed, but the establishment costs in the revised estimates exceeded. Hence the allowance has been increased to 18%. The cost has also been compared with the probable establishment costs as computed from the statement of establishment required, *vide* Appendix F- II.

UNIT No. 5—MONTGOMERY-PARKPATAN LINK.

7. The estimate for this canal is based on a very thorough and complete survey and longitudinal section.

The probable expenditure, shown against the various heads of classification, are based on fully detailed designs and estimates. Bridges, falls, etc., are not based merely on a type but on actual designs. These designs and estimates are sufficiently detailed so that they can be used for construction purposes.

An item of Rs. 75,000 has been allowed, as unforeseen, because land prices are always to some extent uncertain, depending on actual awards to be made by acquisition officers.

ARRANGEMENTS FOR STONE.

8. At present there are 400 trucks belonging to the Sutlej Valley headworks. These represent six rakes with a few surplus trucks, and are much in excess of Sutlej Valley requirements. It is proposed to purchase 3 new rakes, making 9 rakes in all. These will be utilized on the Sutlej Valley canals and Haveli project as required, and the charge will be in the form of hire per truck per day, based on purchase price, depreciation, etc. We may assume that a round trip takes 6 days, and that a truck carries 400 cft. of stone. The charge per 100 cft. will then be Rs. 2-10, based on a hire charge of Rs. 1-12 per truck, per day. The analyses of rates show that all the stone will come from Baghanwala quarries, a distance of 122 miles. It will probably be possible, however, to get a small proportion of pitching stone from Hundewali quarries, a distance of 65 miles. The reserve of pitching stone from Hundewali quarries, a distance of 65 miles, forms an appreciable reserve in the estimate of cost.

ANALYSES OF RATES.

9. Rates have been analysed for various items separat
canals and drains and are given as Appendix B—III (a) to (c)

The rate for pitching stone at Baghanwala as taker
Rs. 12/- per % cft.

2	Right & left up- & down- canals	3	Combined road & rail over Rangpur canal	4	Combined road & railway over left bank canal	5	Head regulator of Rangpur canal	6	Head regulators of canals	7	Gates & gearing	8	Iron work for congested railway bridge.
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APP. B-I

It is arrived at as detailed below :—

				Rs. A.
Rate for quarrying at Baghanwala	5 9
Shunting charges	..	..	..	1 3
Incidental	..	..	..	0 3
Surcharge	..	..	..	1 8
Hire of waggon (as per para. 8)	..	..	..	2 10
Unforeseen	..	..	..	0 15
				<hr/>
TOTAL.	..	..	..	12 0
				<hr/>

10. The rates allowed for concrete and stone masonry are based on what was actually paid at Panjnad and are, therefore, liberal for these days. On the whole the rates allowed in the project are definitely liberal and it will be necessary to carefully control the actual rates during construction. It will not be correct to give out project rates on the assumption that they are the minimum. On the contrary project rates have been kept high definitely to insure that a revised project estimate will not be necessary.

TOOLS AND PLANT.

The usual allowance for Tools and Plant is $1\frac{1}{2}$ per cent. In the Sutlej Valley project $1\frac{1}{2}$ percent was allowed for headworks and $2\frac{1}{2}$ percent for canals, but the actual expenditure was $1\frac{1}{4}$ percent on headworks and $1\frac{1}{2}$ percent on canals.

Provision made in this project is 1 percent for headworks and 2 percent for canals. This provision will be ample, as actual expenditure for the Panjnad headworks, the last of the Sutlej Valley series, was less than 1 percent.

MAINTENANCE.

The rates adopted for Sutlej Valley project were $1\frac{1}{2}$ percent for headworks and 3 per cent for canals, but the actual expenditure was less than 1 percent. A provision of 1 percent has, therefore, been made both for the headworks and canals in the Haveli project.

APPENDIX B-I, STATEMENT I-(continued).

DETAILED ABSTRACT OF COST OF C-WORKS OF UNIT NO. 1--TRIMU HEADWORKS.

Serial No.	Name of estimate.	Cement concrete (stone ballast).				Masonry.					Stone pitching.				Stone filling.		
		1 : 2 : 4		1 : 3 : 6		1 : 4 : 8		Brick masonry in cement.	Arch masonry.	Stone masonry in cement.			Grouted pitching.	Dry.	Ordinary.	In trangars.	Fine stone bajri filling.
		3	4	5	6	7	8			Ordinary.	Hammer dressed facing.	Chisel dressed facing.					
		c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	s.ft.	s.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.
1	2	5,970	78,000	34,550	63,000	..	1,50,720	10,700	4,700	..	..	..	..	..	..	..	..
1	Right & left bank walls	70,884	2,34,102	3,20,080	..	..	1,41,848	54,222	12,740	..	..	..	..	..	..	..	..
2	Right & left undersluices	..	..	5,18,800	..	..	..	..	..	..	..	..	..	..	..	..	..
3	Right & left pockets	16,450	90,000	77,740	..	..	1,42,000	55,300	..	..	..	..	..	..	..	..	..
4	Right & left fish ladders	5,900	2,57,750	..	22,500	..	1,05,450	55,030	1,100	..	..	..	..	..	..	..	..
5	Right & left divide walls	7,37,105	12,65,377	22,41,947	..	..	5,25,830	1,42,045	37,318	..	..	..	..	..	..	..	..
6	Weir piers (including adjoining half spans)	00,864	2,35,596	2,72,010	..	..	1,05,018	31,818	2,850	..	..	..	..	..	..	..	..
7	Weir divide piers (including adjoining half spans)	..	..	..	2,50,400	..	..	..	..	..	..	..	..	..	..	..	..
8	Well line downstream of weir	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	Reinforcement	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	Sheet piling	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	Right & left downstream guide banks	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	Right & left upstream guide banks	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	Combined road & railway bridge over Rangpur canal	..	3,100	60,300	..	..	47,200	13,300	..	..	..	..	..	..	..	..	..
14	Combined road & railway bridge over left bank canal	..	9,300	1,42,300	..	..	1,14,040	27,000	..	..	..	..	..	..	..	..	..
15	Head regulator of Rangpur canal	..	..	1,20,200	..	..	1,14,500	17,200	7,400	..	..	..	..	..	..	..	..
16	Head regulators of left bank canals	..	..	2,03,000	..	..	1,20,000	25,700	12,100	..	..	..	..	..	..	..	..
17	Gates & gearing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	Iron work for combined road & railway bridge	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Total	9,12,323	22,99,035	40,10,433	3,41,900	19,440	17,58,312	4,40,415	78,238	51,100	10,13,500	44,50,302	6,97,450	1,73,041	28/- %	24/- %	41,074
	Rate (Rs.)	75/- %	64/- %	57/- %	50 1/2 %	80 1/2 %	80 1/2 %	12 1/2 %	75 1/2 %	61 1/2 %	33 1/2 %	27 1/2 %	28 1/2 %	24 1/2 %	28 1/2 %	24 1/2 %	41,074
	Amount	6,84,242	14,71,382	22,91,077	1,72,000	17,302	15,04,898	55,802	58,070	31,427	3,34,455	12,05,902	1,95,280	1,95,280	1,95,280	1,95,280	41,074

APPENDIX B-I, STATEMENT I—(concluded).

Serial No.	Name of estimate.	Sheet piling.	Well sinking.	Gates & gearing.	Iron work for bridge across Trimmu headworks.	Sand filling.	Centering of arches.	Stone masonry.	Earthwork.	Concrete blocks 1:1:8.	Stone spawls filling.	Reinforced concrete slab.	Reinforced concrete well curb.	Stone ballast under stone pitching.	Wearing coat 1:2:4.	Reinforcement.
1	2	10	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		s.ft.	l.ft.	Rs.	Rsq.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	cwt.
1	Right & left bank walls	..	700	..	..	53,940	..	..	..	2,160	..	..	1,300	..	..	..
2	Right & left abutments	..	..	..	..	..	..	..	..	19,180	..	..	..	..	..	..
3	Right & left pockets	..	..	..	..	..	..	..	..	1,11,100	..	..	..	..	..	..
4	Right & left fish ladders	..	..	..	..	20,400	..	..	..	13,830	1,120	5,100	..	..	..	220
5	Right & left divide walls	..	200	..	..	13,000	..	..	..	71,210	..	..	1,220	..	..	..
6	Weir piers (including adjoining half spans)	..	..	..	..	..	..	..	..	51,432	69,278	..	..	..	21,001	..
7	Weir divide piers (including adjoining half spans)	..	..	..	..	..	..	..	..	..	9,501	..	..	..	..	..
8	Well line downstream of weir	..	7,500	..	..	71,430	..	..	..	..	..	..	26,630	..	..	16,235
9	Reinforcement	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	Sheet piling	2,95,140	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	Right & left downstream guide banks	..	..	..	..	..	..	..	18,08,000	..	1,15,960	..	..	..	..	..
12	Right & left upstream guide banks	..	..	..	..	..	..	..	1,28,10,300	..	1,57,100	..	..	..	..	..
13	Combined road & railway bridge over Rangpur canal	..	..	..	..	..	..	..	..	..	3,300	..	..	..	1,300	..
14	Combined road & railway bridge over left bank canals	..	..	..	..	..	..	..	..	..	..	..	..	2,340	1,000	..
15	Head Regulator of Rangpur canal	..	..	..	..	..	2,150	..	..	..	1,500	..	..	..	..	..
16	Head regulators of left bank canals	..	..	..	..	..	1,000	11,500	..	..	1,000	..	..	..	..	..
17	Gates & gearing	..	..	25,00,000	..	..	..	..	..	..	..	..	..	..	..	..
18	Iron work for combined road & railway bridge	..	..	..	21,01,105	..	..	..	..	..	..	..	..	..	..	..
	TOTAL	2,05,140	8,190	25,00,000	21,01,105	1,58,150	7,350	19,900	1,77,11,300	8,90,010	6,50,502	5,100	32,150	2,340	27,291	16,465
	Rate (Rs.)	350/-	12 1/2	..	..	3 1/2	18 1/2	27 1/2	9	88	200	100	2 1/2	23 1/2	75/-	16/-
	Amount	10,32,990	1,00,800	25,00,000	21,01,108	702	1,378	5,423	1,59,129	1,69,211	1,31,000	5,100	72,338	514	20,468	2,03,440

Cost of bridges debitable to Communication Board & Rly. Deptt. .. Rs. 1,50,92,707
 Total .. Rs. 31,00,990
 Net C. Works .. " 1,19,82,717
 Say .. " 1,19,83,000

APPENDIX B-I STATEMENT II--(continued).

DETAILED ABSTRACT OF COST OF C-WORKS OF UNIT NO. 2--ABDUL HAKIM HEADWORKS--(continued.)

No.	Name of estimate.	CEMENT CONCRETE.			Brick masonry in cement.	STONE MASONRY.				STONE FITTING.		King stone haire.	Well sinking.	Bearing plates
		1:2:4	1:3:6	1:4:8		Arch work.	Ordinary.	Hammer dressed facing.	Chisel dressed facing.	Grouted.	Dry.			
		c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	c.ft.	s.ft.	s.ft.	c.ft.	c.ft.	c.ft.	i ft.	cwt.
1		3,688	52,638	13,674	29,512	..	87,741	13,101	3,900	16,063	..	1,230	412	..
2	Right & left flank wall	723	15,075	19,740	..	..	13,236	1,326	2,508	..	..	4,365	..	..
3	Under-sluices	8,217	..	1,31,929	..	..	..	..	..	..	..	..	..	..
4	Pocket	..	..	17,136	..	..	20,266	13,008	540	..	..	1,068	..	..
5	Fish ladder	3,804	20,428	..	..	..	04,500	17,767	..	..	..	..	..	..
6	Divide wall	2,210	77,800	..	4,410	..	30,990	12,310	6,640	..	..	14,350	45	..
7	Weir, piers & floors	41,810	70,810	1,68,000	..	..	..	..	..	..	..	..	..	..
8	Well wall downstream of weir	..	13,790	..	32,300	..	..	..	..	..	..	..	945	..
9	Abdul Hakim weir road bridge	2,106	..	..	..	..	..	..	..	..	..	..	..	11
10	Head regulator of Sidhmal canal system	632	2,81,540	..	..	11,080	2,14,567	30,468	9,901	14,510	12,672	..	..	..
11	Guide bank right upstream	..	93,024	..	..	..	..	..	..	..	43,145	..	..	..
12	Guide bank left upstream	..	..	..	..	..	..	..	..	..	47,182	..	..	..
13	Guide bank (left & right downstream)	..	..	..	..	..	..	..	..	..	55,430	..	..	..
14	Tail inlet of main canal	..	82,300	..	57,000	..	..	..	..	10,000	..	..	..	..
15	Reinforcement	..	..	..	..	..	..	..	..	..	..	..	..	..
16	Gates & gearing	..	..	..	..	..	..	..	..	..	..	..	..	..
17	Sheet piling	..	..	..	..	..	..	..	..	..	..	..	..	..
18	Unforeseen	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL		63,337	7,07,924	3,83,144	1,23,828	11,066	4,40,300	99,578	23,489	47,475	1,38,459	2,51,786	1,402	11
Rate Rs.		751/2	641/2	171/2	5081/2	891/2	891/2	121/8	751/2	611/8	381/2	271/2	121/8	111/2
Amount ..		47,503	4,53,071	2,18,503	62,533	9,849	3,97,207	12,117	17,017	29,107	62,282	67,982	5,215	161

APPENDIX B--I, STATEMENT II--(concluded).

Serial No.	Name of estimate.	Sheet piling.	Gates & gearing.	Reinforcement.	Angle iron.	Sand filling.	Centering of arches.	Roller steel beams.	Stone masonry.	Earthwork.	Concrete blocks.	Stone spawls filling.	Reinforced concrete slab.	Reinforced concrete well curb.	Brick ballast under piling.	Gas pipes.	Brick arch masonry.	Dry brick piling.	Soling of base.	Unforeseen.
1	Regulator bank wall	sft.	Rs.	cwt.	cwt.	cwt.	sft.	cwt.	cft.	cft.	cft.	cft.	cft.	cft.	cft.	l.ft.	cft.	cft.	cft.	Rs.
2	Under-lances	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Total	53,430	5,14,000	1,807	141	41,106	7,515	845	20,619	15,83,658	2,74,254	80,309	5,350	0,493	1,320	2,268	6,250	0,900	4,100	..
	Rate	350/-/s.ft.	..	10/-cwt	14/-cwt.	5/-%	19/12/-%/s.ft.	12/-cwt.	27/11/-%/c.ft.	9/-%	68/-%	20/-%	100/-%	2/4/c.ft.	20/8/10%	-/8/ft.	50/8/10%	28/10%	20/8/10%	..
	Amount	1,87,005	5,14,000	29,872	1,974	206	1,415	10,140	8,079	14,253	1,80,833	16,080	5,350	11,009	880	1,131	3,156	1,032	841	1,00,000

Rs.

Total	25,08,609
Gates and gearing	5,14,000
Cost of works	19,94,609
5% contingencies	99,730
Total	20,94,339
Say	20,94,000

Serial No.	Name of work.	R. D.	CANAL DATA.		DATA REGARDING MASONRY WORKS.		ITEMS ACTUALLY WORKED OUT.											Centering sq. ft.			
			Bed width ft.	F.S.D. ft.	Span.	No. of spans.	Lime concrete cft.	Pucca masonry cft.	Dry brick pitching cft.	Dry brick ballast cft.	Reinforced concrete cft.	Cement concrete 1:2:4 cft.	Iron work.			Gas pipes lft.	Metalling cft.		Earthwork lks.	R. steel beams cwt.	Bearing plates cwt.
													Reinforced iron cwt.	Angle iron etc. cwt.							
1	V. R. bridge (pro.)	9000	77-0'	8-0'	20'	3	3376	5010	1670	710	870	420	30-0	29-5	572	300	400	119-4	4-8	1000	
2	V. R. bridge (pro.)	20000	"	"	"	"	3376	5040	1670	710	876	420	30-0	29-5	572	300	400	119-4	4-8	1000	
3	D. R. bridge (exi.)	31200	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
4	1-08' Reg. fall (exi) & V. R. bridge (pro.)	47000	77-83	8-0-7-0	{ 17-5' } { 10-0' }	{ 1 } { 1 }	"	"	"	"	781	392	35-3	28-7	488	270	300	98-0	5-0	800	
5	Arterial R. bridge (exi.)	64000	83	7-0	21-8'	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
6	1-38' (14 1/2' exi.) & V. R. bridge (pro.)	91000	83-74	7-0-7-5	20'	3	"	"	"	"	576	288	25-9	22-2	381	270	300	72-0	3-0	600	
7	0-25' Reg. fall & V. R. bridge (exi.)	98000	74-65	7-5	"	5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
8	2-3' Fall (exi.)	116000	65-58	7-5-8-0	16-3'	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
9	Bridge (exi.)	120000	58	8-0	21-0'	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
10	2-0' Reg. fall (exi.) & V. R. bridge (pro.)	137200	58-48	8-0	18-5'	2	"	"	"	"	368	184	16-6	15-7	280	270	300	40-0	2-0	370	
11	Bridge (exi.)	116000	48	8-0	10-0'	4	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
12	2-28' fall (exi.) & V. R. bridge	160000	48-52	8-0-7-5	16-0'	2	"	"	"	"	328	164	14-8	14-5	260	270	300	41-0	2-0	320	
13	1-6' R. fall & A. R. bridge (exi.)	177700	52-42	7-5-6-0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
Carried over							6,752	10,080	3,340	1,180	3,796	1,808	170-0	140-1	2,556	1,680	2,000	495-8	21-0	4,050	

APPENDIX B-I, STATEMENT III (b)---(concluded.)

Serial No.		Name of work.	GENERAL DATA.		DATA REGARDING MASONRY WORKS.		ITEMS ACTUALLY WORKED OUT.														
			R. D.	Bed width ft.	R.S.D. ft.	Span ft.	No. of spans.	Lime concrete c.ft.	Racca masonry c.ft.	Dry brick pitch- ing c.ft.	Dry brick ballast c.ft.	Reinforced con- crete c.ft.	Cement concrete 1:2-4 c.ft.	Iron work.		Gas pipes l.ft.	Metalling c.ft.	Earthwork Rs.	R. steel beams cwt.	Bearing plates cwt.	Centring, s.ft.
														Reinforce- ment cwt.	Angle iron cto. cwt.						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
14	<i>Brought forward</i>	103000	42	0-9	20'	3	0792	10080	3340	1480	3706	1808	170-6	110-1	2556	1680	2000	497-8	21-0	4090	
15	V. R. bridge (pro.)	203100	42	0-9	20'	2	2030	3230	930	370	520	250	23-0	19-4	390	300	400	71-6	2-9	600	
16	Railway bridge (ext.)	204000	42	0-9	7-5'	4	0125	9570	1700	1000	485	170	21-8	8-8	278	270	400	..	..	..
17	1-0' Reg. fall & V. R. bridge (pro.)	217000	41	0-6	7-5'	3	5370	8700	1600	1010	370	130	10-7	7-4	236	270	400	..	..	375
18	0-5' Reg. fall & V. R. B. (pro.)	230000	36	0-6	7-5'	3	5020	7050	1540	950	110	30	5-0	7-8	232	130	400	..	..	280
19	1-0' Reg. fall & F. B. (pro.)	241300	36	0-4	20'	3	2036	3230	930	370	520	250	23-0	19-4	390	300	400	71-6	2-9	130	
20	V. R. B. (pro.)	215000	36	0-4	7-5'	3	4950	8040	1510	930	110	30	5-0	7-8	232	130	400	..	..	600
21	1-25' Reg. fall & F. B. (pro.)	250000	34	0-2	20'	3	2030	3230	930	370	520	250	23-0	19-4	390	300	400	71-6	2-9	150	
22	V. R. B. (pro.)	260000	34	0-2	7-5'	3	1710	7310	1300	860	110	30	5-0	7-8	232	130	400	..	..	600
23	1-0' Reg. fall & F. B.	277000	30	5-8	30'	1	7505	10370	1390	890	580	200	50-4	12-8	240	540	400	114-0	3-2	130	
24	5-35' Reg. fall & A. R. B.	223000	30	5-0	7-5'	3	5770	7530	1270	700	370	130	16-7	7-4	236	270	400	..	..	615
25	3-0' Fall & V. R. B. (pro.)		29																	280	
Total			..	..	..	..	32870	70300	10,630	9080	7491	3,428	300-2	258-1	6412	4290	6000	854-6	33-5	7,890

APPENDIX B-I, STATEMENT III (c)—concluded.

Name of work.		R. D.	CANAL DATA.		DATA REQUIRED FOR MASONRY WORKS.		ITEMS ACTUALLY WORKED OUT.														
			Bed width ft.	F.S.D. ft.	Span ft.	No. of spans.	Lime concrete cft.	Racca masonry cft.	Dry brick pitching cft.	Dry brick ballast cft.	Reinforced concrete cft.	Cement concrete 1:2:4 cft.	Iron work.			Metalling cft.	Earthwork cu. yds.	R. steel beam cwt.	Bearing plates cwt.	Centering sq. ft.	
													Reinforcement cwt.	Angle iron, etc cwt.	Gas pipes lb.						
Serial No.																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
20	Brought forward	..					105,103	227,803	51,050	27,820	24,701	11,008	1,108.9	623.5	12,778	5,830	7,600	2,028.2	107.3	25,050	
21	V. Road bridge	205,000	100	6-7	20	6	4,016	5,460	1,900	920	1,038	198	47	34.5	664	300	406	143.3	5.7	1,200	
22	2-3' Regulating fall & V. R. bridge (Boran)	218,000	100	6-7	7-5	6	18,251	18,977	5,883	3,077	978	224	30.5	13.7	360	284	500	..	..	450
23	2-0' Fall & V. R. bridge	250,000	72	5-9	7-5	7	11,780	13,010	2,520	1,580	830	290	31.4	13.0	404	270	400	..	..	660
24	V. Road bridge	218,500	72	5-8	20	4	2,700	3,600	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800	
25	V. Road bridge	210,500	72	5-8	20	4	2,700	3,600	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800	
26	2-25' Regulating fall & V. R. bridge	254,000	72	5-8	7-5	6	10,810	12,980	2,410	1,520	715	250	32.2	11.6	302	270	400	..	..	560
27	Existing bridge	258,000	70	5-7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	V. R. bridge	270,000	70	5-7	20	4	2,700	3,600	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800	
29	Existing bridge	287,000	70	5-7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	1-32' Reg. fall & V. R. bridge	206,660	70	5-7	7-5	6	8,815	11,400	2,200	1,110	715	250	32.2	11.6	312	270	400	..	..	560
31	V. R. bridge	302,000	62	5-5	20	4	2,700	3,000	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800	
32	V. R. bridge	308,500	62	5-5	..	..	2,700	3,600	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800
33	V. R. bridge	310,000	62	5-5	..	..	2,700	3,600	1,260	550	602	332	31	21.1	180	300	400	95.5	3.8	800
34	A. R. bridge (existing)	330,000	62	5-5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
35	N. W. R. bridge (existing)	331,000	62	5-5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
			Total quantities				205125	312822	74003	40267	32829	14512	1774.2	854.3	17830	9024	12100	3344.5	136.8	35220	

APPENDIX B-I, STATEMENT III (d) — (continued).
DETAILS OF ESTIMATED QUANTITIES AND COST FOR MASONRY WORKS ON RANGPUR NON-PERENNIAL CANAL.

Serial No.	Name of work.	CANAL DATA		DATA OF MASONRY WORKS.		R. D.	ITEMS WORKED OUT ACTUALLY.										Lump sum.				
		Bed width ft.	R.S.P. ft.	Span ft.	No. of spans.		Lime concrete c.ft.	Face masonry c.ft.	Dry brick pitching c.ft.	Dry brick ballast c.ft.	Reinforced concrete c.ft.	Cement concrete 1:2:4 c.ft.	Iron work.		Gas pipes lft.	Metalling c.ft.		Earthwork Rs.	Rolled steel beams cwt.	Bearing plates ovt.	Centering s.ft.
													Reinforce- ment cwt.	Angle iron, etc. cwt.							
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1	6-4' Regulating fall V. R. bridge and power plant.	110	7-0	20	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Rs. 75,000
2	V. R. bridge	110	6-3	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
3	D. R. bridge	..	..	..	..	5946	8300	2310	1100	2065	980	186	45-0	756	420	400	316-3	13-3	2170	..
4	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
5	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
6	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
7	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
8	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
9	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
10	V. R. bridge	..	..	..	..	4716	6200	2310	1100	1211	581	54	39-6	756	300	400	107-2	6-7	1400	..
11	2-0' Fall and V. R. bridge	110	6-9	7.5	0	12760	16680	3370	2150	1060	370	48-2	15-8	488	270	400	..	..	675	..
12	V. R. bridge	95	6-9	20	6	4046	5460	1990	920	1038	499	47-1	34-5	674	200	400	143-3	5-7	1200	..	
13	1-62' Regulating fall & V. R. bridge	95	6-9	7.5	9	21050	21140	3200	2010	1060	370	47-7	15-8	488	270	400	..	..	840	..
14	V. R. bridge	..	..	20	6	4016	5460	1990	920	1038	198	47	34-5	674	300	400	143-3	5-7	1200	..
15	V. R. bridge	..	..	..	..	4016	5460	1990	920	1038	198	47	34-5	674	300	400	143-3	5-7	1200	..
16	V. R. bridge	..	..	..	..	4016	5460	1990	920	1038	198	47	34-5	674	300	400	143-3	5-7	1200	..
17	2-5' Regulating fall & V. R. bridge	92	6-8	7.5	8	13490	16695	2980	1880	915	330	42-5	14-1	146	270	400	..	..	730	..
18	V. R. bridge	82	6-5	..	..	3376	4720	1640	740	870	120	39-0	20-5	572	300	400	119-4	4-8	1000	..
19	V. R. bridge	..	..	20	5	3376	4720	1640	740	870	120	39-0	20-5	572	300	400	119-4	4-8	1000	..
20	3-5' fall & V. R. bridge	..	..	7.5	8	13330	18025	2890	1810	945	330	43-0	14-1	146	270	400	..	..	600	..
21	V. R. bridge	..	..	20	5	3376	4720	1640	740	870	120	39-0	20-5	572	300	400	119-4	4-8	1000	..
22	2-0' Regulating fall & V. R. bridge	82	6-3	7.5	7	10480	14160	2910	1770	830	200	37-4	13-0	401	270	400	..	..	660	..
23	V. R. bridge	89	6-2	..	..	3376	4720	1640	740	870	120	39-0	20-5	572	300	400	119-4	4-8	1000	..
24	V. R. bridge	..	..	20	5	3376	4720	1640	740	870	120	39-0	20-5	572	300	400	119-4	4-8	1000	..
CARRIED OVER		..	..	..	..	159448	103010	52470	20900	25005	11110	1210-8	720-7	14502	6870	9200	2834-1	113-7	26605	Rs. 75,000

APPENDIX B-I. STATEMENT IV.
STATEMENT SHOWING LENGTH OF MAIN CANALS AND BRANCHES.

Particulars.	R. D.		Main canals (miles).	BRANCHES.	
	From	To		New reaches (miles).	Reaches to be remodelled (miles).
1	2	3	4	5	6
<i>Main canal</i>	0	2,28,000	49.6	..	..
<i>Sidhnai Canal—</i>					
New reach	0	30,000	..	6.0	..
Sidhnai canal (existing)	30,000	1,60,000	..	..	26.0
Makhdun Rashid Disty. (existing)	1,00,000	2,75,000	..	..	23.4
New reach	2,75,000	3,01,000	..	4.8	..
Total .. .. .	..	..	..	10.8	49.4
<i>Multan Branch—</i>					
New reach	0	1,36,500	..	27.3	..
Mattital canal (existing)	1,36,500	1,42,500	..	..	1.2
New reach	1,42,500	1,55,000	..	2.5	..
Wali Mohd. (existing)	1,55,000	1,09,000	..	..	2.8
New reach	1,69,000	1,81,500	..	2.5	..
Wali Mohd. (existing)	1,81,500	1,01,500	..	..	2.6
New reach	1,91,500	2,12,500	..	3.0	..
Wali Mohd. (existing)	2,12,500	2,18,000	..	..	1.1
New reach	2,18,000	2,20,500	..	2.3	..
Sikandarabad (existing)	2,20,500	2,93,500	..	..	12.8
New reach	2,93,500	3,27,000	..	6.7	..
Sikandarabad (existing)	3,27,000	3,10,100	..	..	4.5
Total .. .. .	..	..	..	41.0	25.0
Rangpur canal	0	4,72,600	91.1	..	..
Grand total .. .. .	..	..	111.0	55.7	74.1

N. B.—Distributaries and minors have been estimated on acreage basis, on the past experience of the Sutlej Valley project. Hence their details are not given. Old subsidiary canals, i.e., Adul Hakim, Koranga Fazilshah and New Shorkot Branch carrying discharges less than 500 cusecs have also been treated as distributaries under the project and their details of length have not, therefore, been given in this statement.

APPENDIX B-II.
ABSTRACTS OF COSTS.

APPENDIX B-II.

GENERAL ABSTRACT OF COST OF HAVELI PROJECT (1935).

Main Head.	Cost.
<i>"Direct Charges."</i>	Rs.
I—Works of Headworks—	
Trimmu headworks	2,07,93,000
Abdul Hakim headworks	35,28,000
Total I-Works of Headworks	2,43,21,000
I—Works of Main Canal and Branches—	
Left bank canals	1,47,56,000
Rangpur canal	67,79,000
Montgomery—Pakpattan Link	9,61,000
Total I-Works of Main Canal and Branches	2,24,99,000
I—Works (Total)	4,68,20,000
II—Establishment	66,95,000
III—Tools and Plant	6,93,000
IV—Suspense .. .. .	..
Total I—IV	5,42,08,000
V—Receipts on Capital Account	12,99,000
Total "Direct Charges"	5,29,09,000
<i>"Indirect Charges."</i>	
VI (1) Capitalization of abatement of Land Revenue	1,97,000
(2) Audit Charges	4,69,000
Total "Indirect Charges"	6,66,000
GRAND TOTAL	5,35,75,000

Ann. B II

UNIT No. 1—TRIMMU HEADWORKS.

Abstract of Cost.

Heads of Classification.	Amount.
<i>"Direct Charges."</i>	
I—Works (1) Head Works—	Rs.
A. Preliminary	35,000
B. Land	19,20,000
C. Works	1,56,29,000
K. Buildings	5,63,000
M. Plantation	10,000
O. Miscellaneous	1,85,000
P. Maintenance	1,76,000
R. Railways	11,49,000
I—Works (1) Head Works (Total)	1,16,67,000
I—Works (6) Special Tools and Plant	10,76,000
I—Works (7) Losses on Stock	50,000
I—Works (Total)	2,07,93,000
II—Establishment	17,77,000
III—Tools and Plant 1% of I—Works	2,08,000
IV—Suspense .. .. .	..
V—Receipts on Capital Account	—1,00,000
Total "Direct Charges"	2,26,78,000
<i>"Indirect Charges."</i>	
VI (1) Capitalization of abatement of Land Revenue (a 5% of B—Land.	96,000
(2) Audit Charges (a 1% of I—Works	2,08,000
Total Indirect Charges	3,04,000
Total II to VI	21,89,000
Grand Total Direct and Indirect Charges	2,29,82,000

UNIT No. 1—TRIMMU HEADWORKS—*contd.**I—Works (I) Head Works.*

Item No.	Particulars.	Amount.	Total.
A—PRELIMINARY.			
1	Preliminary Surveys	Rs. 30,000	Rs.
2	Cost of the Opening Ceremony .. .	5,000	35,000
Total A—Preliminary ..			35,000
B—LAND.			
1	Under pond and marginal bunds :— 25,500 acres @ Rs. 60/- per acre	15,30,000	
2	Under headworks :— 1,500 acres @ Rs. 250/- per acre	3,75,000	
3	For railway line :— 60 acres @ Rs. 250/- per acre	15,000	19,20,000
Total B—Land ..			19,20,000
C—WORKS.			
1	Weir, undersluices, regulators, and guide banks as per detailed abstract (Appendix B-I, Statement I) ..	1,19,83,000	
2	Right marginal bund (as estimated)	4,06,000	
3	Left marginal bund (as estimated) .. .	2,58,000	
	Total	1,26,47,000	
4	Contingencies @ 5 % .. .	6,32,000	
	Total	1,32,79,000	
5	Earthwork in weir area—5,00,00,000 cft. @ Rs. 16/- % ₁₀₀ cft.	8,00,000	
6	Pumping, lump sum	10,00,000	
7	River diversion and miscellaneous, protection works ..	5,50,000	1,56,29,000
Total C—Works			1,56,29,000

APP. B-II

UNIT No. 1—TRIMMU HEADWORKS—*contd.**I—Work (1) Head Works.*

Item No.	Class of building.	Particulars.	Amount.	Total
		K.—BUILDINGS.		
			Rs.	Rs.
1	Permanent	Officers rest house	31,500	
2	"	Executive Engineer's bungalow	22,500	
3	Temporary	Sub-Divisional Officers bungalows 4 No.	42,560	
4	Permanent	Sub-Divisional Officer's bungalow	13,600	
5	"	Telegraph office and signallers' quarters combined with guard room and telephone exchange	9,600	
6	"	Subordinate rest house	4,000	
7	"	Quarters for subordinates 2 No.	6,800	
8	Temporary	Quarters for subordinates 24 No.	38,400	
9	"	Combined offices of the Executive Engineer and Sub-Divisional Officers	15,000	
10	"	Dragline operators' quarters 3 No.	5,334	
11	"	Senior clerks quarters 6 No.	11,202	
12	"	Junior clerks quarters 25 No.	30,000	
13	"	Dispensary and assistant surgeon's quarters	6,667	
14	"	Fitters quarters 64 in 8 blocks	14,400	
15	"	Menials quarters 64 in 8 blocks	14,400	
16	"	Quarters for 6 loco. staff married and 6 loco. staff single and one assistant foreman 1 block	4,400	
17	"	Wiremen's quarters "married" 8 in a block	3,200	
18	"	Wiremen's quarters "single" 8 in a block	1,920	
19	"	Quarters for superior power house staff (1 foreman, 3 shift engineers) 1 block	5,000	
20	"	6 Drivers and 1 foreman's quarters 1 block	3,600	
21	"	1 Stationmaster's quarters "married"	2,334	
22	Permanent	Post and Telegraph Office	3,334	
23	Temporary	Station buildings	3,334	
24	"	Stationmaster's quarters and Telegraph Office	2,000	
		Carried over	2,95,085	

UNIT No. 1—TRIMMU HEADWORKS—*contd.**I—Works (1) Head Works—contd.*

Item No.	Class of Building.	Particulars.	Amount.	Total.
			Rs.	Rs.
		Brought forward ..	2,95,085	
		K.—BUILDINGS— <i>concl.</i>		
25	Permanent	Stationmaster's quarters and Telegraph Office ..	4,000	
26	Temporary	1 P. W. I.'s quarters (Mudduki) combined with one overseer's quarters ..	6,800	
27	"	8 Gangmen's (plate layers) "single" quarters 1 block ..	1,480	
28	"	8 Gangmen's (plate layers) "married" quarters 1 block ..	1,800	
29	"	16 Gangmen's (plate layers) "single" quarters 1 block ..	3,280	
30	"	1 Sub P. W. I.'s quarters ..	1,200	
31	"	Trollymen's quarters 20 in 2 blocks ..	2,960	
32	Permanent	Coolies quarters 40 in 4 blocks ..	5,920	
33	Temporary	Signallers quarters and office for kiln siding ..	2,000	
34	Permanent	Regulating beldais' quarters ..	31,600	
35	"	Power house ..	35,000	
36	Temporary	Workshops, head stores, chaukidars huts, platform, offices of Sub-Divisional officers, power and transport ..	50,000	
37	"	Godowns ..	18,080	
38	Permanent	School for children of staff ..	2,324	
39	Temporary	Butcher's shop ..	1,667	
40	"	Ten shops in bazar ..	6,670	
41	Miscellaneous	Latrines and drainages ..	6,670	
42	"	Lights and fans in station area ..	11,324	
43	"	Plantation <i>gamlas</i> ..	834	
44	"	Levelling ground and jungle clearance ..	4,000	
45	"	Fencing in and around station area ..	3,334	
46	"	Ornamental gardens in station area ..	20,000	
47	"	Raising permanent building site area to formation level ..	25,000	
48	"	Water supply ..	5,318	5,63,018
Total K—Buildings ..			5,63,018	5,63,000

APP. B-II

UNIT No. 1—TRIMMU HEADWORKS—*contd.**I—Works (I) Head Works—contd.*

Item No.	Particulars.	Amount.	Total.
	M—PLANTATION.		
	Lump sum	Rs. 10,000	Rs. 10,000
	Total M—Plantation		10,000

O—MISCELLANEOUS.

1	Discharge observations	20,000	
2	Maintaining boat for works, etc.	10,000	
3	Running motor launch	20,000	
4	Running inspection trollies	25,000	
5	Lighting for works	20,000	
6	Conservancy, etc.	25,000	
7	Fencing station area	10,000	
8	Boundary pillars, etc.	10,000	
	<i>Arrangements in connection with general health and sanitation.</i>		
9	Malaria control	10,000	
10	Sanitation	20,000	
11	Recreation centres and playing fields	5,000	
12	Unforeseen	10,000	1,85,000
	Total O—Miscellaneous		1,85,000

P—MAINTENANCE.

	1% of total (I) Head Works excluding B—Land and P—Maintenance, i.e., $\frac{1}{100} \times 1,75,71,000 =$..	1,75,710	1,75,710
	Total P—Maintenance .. say		1,76,000

R—RAILWAYS.

1	<i>B. G. Siding half mile long each.</i> 3 No. for Mudduki. 3 No. for Trimmu. 2 No. Intermediate. 8 No. (Total) ..	1,60,000	
2	Permanent railway line B. G. 75 lb. 6 miles ..	2,40,000	
3	Temporary tracks 15 miles	6,75,000	
4	3 No. Railway stations	15,000	
5	2 No. Watering stations	24,000	
6	Watercourse and drainage crossings	18,000	
7	Permanent line (earthwork)	17,000	11,49,000
	Total R.—Railways		11,49,000

UNIT No. 1—TRIMMU HEADWORKS—*contd.**I—Works (I) Head Works—contd.*

Item No.	Particulars.	Amount.	Total.
I—WORKS (6) SPECIAL TOOLS AND PLANT.		(Rs.)	(Rs.)
(a) <i>B. G. Plant.</i>			
1	B. G. Locos 4 No.	1,00,000	
2	B. G. Sentinel loco	30,000	
3	Trucks for internal traffic 120 No.	72,000	
4	Brake vans 3 No.	9,000	
5	Officer's carriage	5,000	
6	Motor trolley	3,000	
7	Weigh bridge	15,000	
8	Turntable	8,000	
9	Loco sheds and ash pits 2 No.	36,000	
10	Push trollies 8 No.	2,400	2,80,400
(b) <i>Tramway Plant.</i>			
1	1 C. yard tip waggons 500 No.	1,25,000	
2	Sentinel locos N. G. 6 No. (second hand)	36,000	
3	Track 18 lb. 12 miles	1,20,000	
4	80 No. points and crossings	12,000	2,93,000
(c) <i>Piling Plant.</i>			
1	Pile drivers 2 No. second hand	30,000	
2	1 No. new	25,000	55,000
(d) <i>Workshop.</i>			
1	Tools	8,000	8,000
(e) <i>Pneumatic Plant.</i>			
1	2 Big compressors (2nd hand)	16,000	
2	1 Small compressor (2nd hand)	5,000	
3	Pneumatic tools and accessories	10,000	31,000
(f) <i>Crab Winches.</i>			
1	24 No. (2nd hand)	12,000	12,000
(g) <i>Power Plant.</i>			
1	3 No. Generating sets 140 K. W. sets	1,65,000	
2	1 No. Generating set 60 K. W. set	20,000	
3	Accessory plant in power house	15,000	
4	Transformers and sub-station equipment (second hand) 3 sets	24,000	
5	Testing set	1,000	
<i>Transmission Lines.</i>			
6	H. T. Line 2 miles	14,000	
7	L. T. Line 1 mile	11,000	
8	L. T. Line 3 miles	15,000	
9	Erection of power plant and sub-stations	15,000	
10	Fuel oil storage tanks (second hand) 5 No.	10,000	
11	Tube well and pumping set	5,000	2,95,000
(h) <i>Pumping Plant.</i>			
1	5 No. motor sets new	25,000	
2	25 No. motor sets (second hand)	50,000	
3	4 No. Oil engine driven sets	12,000	
4	Hand pumps (2nd hand) L. S.	2,500	
5	Merry weather pumps 2 No.	10,000	99,500
Carried over			10,73,900

APP. B-II

UNIT No. 1—TRIMMU HEADWORKS—*contd.*I—Works (1) Head Works—*contd.*

Item No.	Particulars.	Amount.	Total.
		Rs.	Rs.
	Brought forward .. ..	..	10,73,900
	(6) SPECIAL TOOLS AND PLANT—(concluded).		
	(i) Concrete Mixers.		
1	4 big (2nd hand)	16,000	
2	3 big new	27,000	
3	2 small (2nd hand)	6,000	
4	12 No. hand mixers	3,600	52,600
	(j) Dredging Plant.		
1	Dredging pump (2nd hand)	2,000	
2	Hand dredgers (2nd hand) 30 No.	2,250	
3	12 No. new	2,400	6,650
	(k) Cranes.		
1	Steam crane 10 tons (2nd hand) 1 No.	7,000	7,000
	(l) Hoists.		
1	Electric hoists (2nd hand) 4 No.	4,000	
2	Steam hoists (2nd hand)	1,500	5,500
	(m) Excavators.		
1	Dragline excavators new 2 No.	1,00,000	1,00,000
	(n) Motor Launch.		
1	1 No. motor launch	17,000	17,000
	(o) Steam Engine and Other Machinery.		
1	Portable steam engine (2nd hand)	2,500	
2	2 No. stone crushers (2nd hand)	7,000	
3	2 No. stone crushers new	16,000	
4	Granulator (2nd hand)	3,000	
5	Granulator new	5,000	
6	Jacks, screw and hydraulic, 12 No.	3,600	
7	Weighing machines 3 No.	1,500	
8	Pulley blocks geared 12 No.	6,000	
9	Sheave pulley blocks 50 No.	1,500	
10	Ice plant	8,000	54,100
	(p) Miscellaneous tools and plant L. S.	20,000	20,000
	(q) Electric installations and fans L. S.	7,500	7,500
	Tools and plant grand total		13,44,250
		say	13,44,000
	Deduct—(1) 10% sale value	1,34,000	
	(2) 10% debitable to Abdul Hakim head-works	1,34,000	2,68,000
	Balance (6) Special T. and P. net amount		10,76,000

I—WORKS (7) LOSSES ON STOCK.

Damage to materials and other consequent losses ..	50,000	50,000
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UNIT No. 1—TRIMMU HEADWORKS—*concl'd.*

Particulars.	Amount.	Total.
	Rs.	Rs.
II—ESTABLISHMENT.		
(a) Establishment— $7\frac{1}{2}\%$ of I—Works $= \frac{7.5}{100} \times 2,07,93,000$	15,59,475	
(b) Leave salary— $6\frac{1}{2}\%$ of (a) Establishment $= \frac{6.5}{100} \times 15,59,475$	1,01,366	
(c) Pensionary charges 7% of (a) Establishment plus (b) Leave salary $= \frac{7}{100} \times 16,60,841$	1,16,259	17,77,100
Total II—Establishment	say	17,77,000
III—TOOLS AND PLANT.		
1% of I—Works, i.e., of Rs. 2,07,93,000	2,07,930	say 2,08,000
IV—SUSPENSE.		
<i>Nil.</i>		
V—RECEIPTS ON CAPITAL ACCOUNT.		
(1) Receipts on Capital Account	1,00,000	..
(2) House rent	50,000	1,50,000
Deduct for free rents to construction officers	—50,000	—50,000
Total V—Receipts on Capital Account.		1,00,000
VI—"INDIRECT CHARGES."		
(1) Capitalization of abatement of land revenue @ 5% of land $= \frac{5}{100} \times 19,20,000$	96,000	96,000
(2) Audit charges @ 1% of I—Works, i. e., of Rs. 2,07,93,000	2,07,930	say 2,08,000
Total VI—Indirect Charges		3,04,000

APP. B-II

UNIT No. 2—ABDUL HAKIM HEADWORKS.

Abstract of Cost.

Heads of Classification.				Amount.
<i>"Direct Charges."</i>				
I—Works (1) Headworks—				Rs.
A—Preliminary	..	..	..	20,000
B—Land	..	..	..	1 38,000
C—Works	..	..	..	28,18,000
K—Buildings	..	..	..	70,000
M—Plantation	..	..	..	5,000
O—Miscellaneous	..	..	..	27,000
P—Maintenance	..	..	..	31,000
R—Railways	..	..	..	1,40,000
I—Works (1) Headworks (Total)	..	..	..	52,49,000
I—Works (6) Special Tools and Plant	..	..	..	2,69,000
I—Works (7) Losses on Stock	..	..	..	10,000
I—Works—(Total)	..	..	..	35,28,000
II—Establishment	..	..	..	3,02,000
III—Tools and Plant 1% of I—Works	..	..	..	35,000
IV—Suspense	..	..	..	..
V—Receipts on Capital Account	..	..	..	—5,000
Total "Direct Charges"	..	..	..	39,60,000
<i>"Indirect Charges."</i>				
VI—(1) Capitalization of abatement of land revenue				
5% of B—Land	..	..	..	7,000
(2) Audit Charges 1% of I—Works	..	..	..	35,000
Total "Indirect Charges"	..	..	..	42,000
Total II to VI	..	..	..	3,74,000
Total "Direct and Indirect Charges"	..	..	..	39,02,000

UNIT No. 2—ABDUL HAKIM HEADWORKS—*contd.*

I—WORKS (I) HEAD WORKS.

Item No.	Particulars.	Amount.	Total.
A—PRELIMINARY.			
	Preliminary observations and surveys ..	Rs. 20,000	Rs. 20,000

B—LAND.

1	Stacking ground and outside river 330 acres @ 250/- per acre ..	75,000	
2	River and protection works 250 acres @ 250/- per acre ..	62,500	1,37,500
Total B—Land ..		say	1,38,000

C—WORKS.

1	Masonry and protection works as per detailed abstract (App. B-I, Statement II) ..	20,94,000	
2	Head of Koranga canal L.S. ..	20,000	
3	Gates and gearing as estimated ..	5,14,000	
4	Earthwork site clearance, etc., L.S. ..	1,00,000	
5	Pumping L.S. ..	60,000	
6	River diversion, etc. ..	30,000	28,18,000
Total C—Works ..			28,18,000

K—BUILDINGS.

1	1 Temporary S. D. O.'s bungalow ..	10,700	
2	1 Temporary S. D. O.'s office ..	2,400	
3	2 Overseers quarters ..	6,800	
4	1 Telegraph office and signaller's quarter ..	3,000	
5	16 Fitters quarters 2 blocks ..	3,600	
6	16 Gangmen's quarters 2 blocks ..	3,600	
7	16 Menials quarters 2 blocks ..	3,600	
8	Drivers' quarters 1 block ..	2,500	
9	2 Junior clerks quarters ..	2,400	
10	12 Beldars' quarters ..	9,600	
11	Unforeseen ..	2,000	
12	1 Temporary divisional office and staff quarters ..	20,000	70,200
Total K—Buildings ..		say	70,000

M—PLANTATION.

	Planting trees round the area ..	5,000	5,000
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O—MISCELLANEOUS.

1	Fencing station ..	3,000	
2	Boundary pillars, etc. ..	2,000	
3	Running trolleys ..	2,000	
4	Conservancy ..	5,000	
5	Lighting works ..	3,000	
6	Discharge observations ..	2,500	
7	Unforeseen ..	2,500	
<i>Provision in connection with general health and sanitation—</i>			
8	Malaria control ..	2,000	
9	Sanitation ..	4,000	
10	Recreation centres and playing grounds ..	1,000	27,000
Total O—Miscellaneous ..			27,000

App. B-II.

UNIT No. 2—ABDUL HAKIM HEADWORKS—concl'd.

Item No.	Particulars.	Amount.	Total.
P.—MAINTENANCE.			
	1% of (1) Headworks less B—Land ..	Rs. 30,800	Rs. say 31,000
R.—RAILWAYS.			
1	Railway line 2 miles	82,000	
2	Temporary siding 4 No.	40,000	
3	Water tank 1 No.	10,000	
4	Line on works	10,000	1,40,000
	Total R—Railways .. ..	..	1,40,000

I WORKS (6) SPECIAL TOOLS AND PLANT.

20% of Rs. 13,41,251 (required for Trimmu Head Works)	2,69,000	2,69,000
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(7) LOSSES ON STOCK.

Damage to materials and consequent losses ..	10,000	10,000
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II—ESTABLISHMENT.

(a) Establishment @ $7\frac{1}{2}\%$ of I—Works, i.e., $\frac{7.5}{100} \times 35,28,000$	2,64,600	
(b) Leave salary 6.5% of (a) Establishment $\frac{6.5}{100} \times 2,64,600$	17,199	
(c) Pensionary charges @ 7% of (a) Establishment plus (b) Leave salary = $\frac{7}{100} \times 2,81,799$	19,726	3,01,525
Total II—Establishment	say	3,02,000

III—TOOLS AND PLANT.

1% of I—Works, i.e., Rs. 35,28,000	35,280	say 35,000
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IV—SUSPENSE.

Nil

V—RECEIPTS ON CAPITAL ACCOUNT.

Sales and house rent, etc.	—5,000	—5,000
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VI—"INDIRECT CHARGES."

(1) Capitalization of abatement of land revenue (5% of B—Land) $\frac{1,38,000 \times 5}{100}$	6,900	say 7,000
(2) Audit Charges (1% of I—Works) $\frac{35,28,000 \times 1}{100}$	35,280	say 35,000
Total VI—"Indirect charges"		42,000

UNIT No. 3—LEFT BANK CANALS.

Abstract of Cost.

Heads of Classification.					Cost.
					Rs.
<i>"Direct Charges."</i>					
1—Works (2) Main Canal and branches—					
A.—Preliminary	..	..	..	..	40,000
B.—Land	..	..	..	..	11,76,000
D.—Regulators	..	..	..	..	..
E.—Falls	..	..	..	..	2,05,000
F.—River and hill torrent works	..	..	..	..	..
F.—(1) Other cross drainage works	..	..	..	..	1,57,000
G.—Bridges	..	..	..	..	8,50,000
H.—Escapes	..	..	..	..	..
I.—Navigation works	..	..	..	..	..
J.—Mills	..	..	..	..	..
K.—Buildings	..	..	..	..	4,62,000
L.—Earthwork	..	..	..	..	46,93,000
L (1).—Service and boundary roads..	..	..	..	..	16,000
L (2).—Core walls	..	..	..	..	7,53,000
M.—Plantations	..	..	..	..	18,000
O.—Miscellaneous	..	..	..	..	95,000
P.—Maintenance	..	..	..	..	73,000
Unforeseen	..	..	..	..	2,00,000
I—Works (2) Main Canal and Branches—(Total)					87,38,000
I—Works (3) Distributaries					24,50,000
I—Works (4) Drainage and Protective Works					14,15,000
I—Works (5) Watercourses					7,43,000
I—Works (6) Special Tools and Plant					4,00,000
I—Works (7) Losses on Stock					10,000
I—Works (Total)					1,47,56,000
II—Establishment					30,27,000
III—Tools and Plant @ 2% of I—Works					2,95,000
IV—Suspense					..
Total I—IV					1,80,78,000
V—Receipts on Capital Account					—6,97,000
Total "Direct Charges"					1,73,81,000
<i>"Indirect Charges."</i>					
VI (1) Capitalization of abatement of land revenue @ 5% of B—Land					59,000
(2) Audit Charges @ 1% of Total I—Works					1,48,000
Total "Indirect Charges"					2,07,000
Total II to VI					28,32,000
GRAND TOTAL "Direct and Indirect Charges"					1,75,88,000

APP. B-II

UNIT No. 3—LEFT BANK CANALS—*contd.*
I—WORKS (2) MAIN CANAL AND BRANCHES.
A—PRELIMINARY.

Item No.	Particulars.	Amount.	Total.
		Rs.	Rs.
1	Main canal surveys—lump sum ..	20,000	
2	Sidhuai canal surveys—lump sum ..	10,000	
3	Multan branch surveys—lump sum ..	10,000	40,000
Total A—Preliminary ..		..	40,000

B—LAND.

Item No.	Particulars.	Area.	Rate per acre.	Amount.	Total.
		Acres.		Rs.	Rs.
1	Main canal (a) Proprietary ..	2,183	250/-	5,45,750	
	(b) Crown waste ..	1,288	10/-	12,880	
2	Sidhuai canal Proprietary ..	395	250/-	98,750	
3	Multan branch—Proprietary ..	2,073	250/-	5,18,250	11,75,630
Total B—Land ..		..	say		11,76,000

D—REGULATORS.

Head Regulators included in the Headworks.

E.—FALLS.

			Rs.	
	(a) New Falls (as estimated)—			
1	Main canal ..	..	..
2	Sidhuai canal ..	..	33,000	
3	Multan branch ..	..	1,17,000	
	(b) Old Falls to be remodelled.			
	Sidhuai canal—R. D. 81000, 98000, 116000, 137200, 160000, 177700, 203742, 216902, 230000, 244700, and 260019=11 No. @ Rs. 5,000/- each		55,000	2,05,000
Total E—Falls ..		..		2,05,000

F—RIVER AND HILL TORRENTS.

Nil.

F (1)—OTHER CROSS DRAINAGE WORKS.

Syphon at R. D. 206,500 of main canal—as estimated	1,57,000	1,57,000
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G.—BRIDGES.

1	Main canal—as estimated ..	4,57,000	
2	Sidhuai canal—as estimated ..	73,000	
3	Multan branch—as estimated ..	3,20,000	8,50,000
Total G—Bridges ..		..	8,50,000

UNIT No. 3—LEFT BANK CANALS—contd.

II.—ESCAPES.

Nil.

I.—NAVIGATION WORKS.

Nil.

J.—MILLS.

Nil.

K.—BUILDINGS.

Item No.	Class of Building.	Particulars.	Amount.	Total.
			Rs.	Rs.
1	Permanent	Executive Engineer's bungalow ..	22,000	
2	"	Executive Engineer's office ..	8,000	
3	"	Sub-Divisional Officers bungalows 2 Nos. ..	27,200	
4	"	Sub-Divisional Officers offices 2 Nos. ..	6,000	
5	Temporary	Sub-Divisional Officers bungalows 2 Nos. ..	20,000	
6	"	Sub-Divisional Officers offices 2 Nos. ..	5,000	
7	"	Junior clerks quarters 4 Nos. ..	4,800	
8	Permanent	Subordinates quarters 15 Nos. ..	45,000	
9	"	Zilladars quarters 6 Nos. ..	24,000	
10	"	Rest houses main line 2 Nos. ..	24,000	
11	"	Gauge readers quarters 16 Nos. ..	12,800	
12	"	Beldars quarters 30 Nos. ..	24,000	
13	"	Mistris quarters 4 Nos. ..	4,800	
14	Temporary	Godowns 8 Nos. ..	16,000	
15	Permanent	Telegraph offices 3 Nos. ..	9,000	
16	"	Dispensaries 2 Nos. ..	12,000	
17	"	Rest houses distributaries 7 Nos. ..	1,05,000	
18	"	Superintending Engineer's bungalow ..	22,000	
19	"	Superintending Engineer's office ..	10,000	
20	Temporary	Operators quarters 6 Nos. ..	12,000	
21	"	Miscellaneous ..	38,000	4 61,000
Total K—Buildings ..			say	4,62,000

L.—EARTHWORK.

Reduced distances.	Quantity or length.	Particulars.	Rate.	Amount.	Total.
	Cit.		Rs.	Rs.	Rs.
Head to tail	40,91,59,520	(a) New Channels— Main canal—as estimated ..	7/12	31,70,986	
0—30000	2,58,27,000	Sidhnai canal ..	6 0/00	1,54,962	
275,000 to 301,000.	84,30,000	" ..	6 0/00	50,580	
0—212000	12,48,24,000	Multan branch ..	6 0/00	7,48,944	
218,000—327,000	1,93,44,000	" ..	58 0/00	1,06,392	
		Total ..		42,31,864	
		Contingencies @ 5% ..		2,11,593	
		Total ..		44,43,457	
	Miles.	(b) Remodelling of old channels :—			
30,000—275,000	49	Sidhnai canal ..	2500/-	1,22,500	
155,000—169,000	2.8	Multan branch ..	5000/-	14,000	
181,800—194,700	2.64	" ..	5000/-	13,200	
212,300—218,000	1.14	" ..	5000/-	5,700	
229,500—293,400	12.78	" ..	2500/-	31,950	
327,000—349,000	4.48	" ..	2500/-	11,200	
0—57000	13.40	Gajju Hatta branch ..	2500/-	33,500	
0—34000	6.8	Sikandarabad canal ..	2500/-	17,000	46,92,507
Total L—Earthwork ..			say,		46,93,000

APP. B-II

UNIT No. 3—LEFT BANK CANALS—*contd.*
 L (1).—SERVICE AND BOUNDARY ROADS.

Particulars.		Rate.	Amount.	Total.
		Per mile.	Rs.	Rs.
45.7 miles	Main canal	200/-	9,140	
11.2 "	Sidhnai canal	200/-	2,240	
23.7 "	Multan branch	200/-	4,740	16,120
Total L (1).—Service and Boundary Roads			say	16,000

L (2).—CORE WALLS.

Clt.	Main canal.			
1,32,450	Cement concrete (1:4)	46/- %	60,927	
13,11,600	Reinforced brickwork	50/- %	6,55,800	
Rs.	Total	..	7,16,727	
716,727	Contingencies	.. 5/- %	35,836	7,52,563
Total L (2).—Core walls			say	7,53,000

M.—PLANTATION.

Particulars.		Amount.	Total.
		Rs.	
Main canal	Lump sum	6,000	
Sidhnai canal	"	6,600	
Multan branch	"	6,000	18,000
Total M—Plantation		..	18,000

O—MISCELLANEOUS.

<i>Main canal.</i>			
Aqueducts for Lower Chenab canal channels as estimated	..	21,000	
Boundary pillars 46 miles @ 120/- per mile	..	5,520	
Distance marks 46 miles @ 200/- per mile	..	9,200	
Bench marks 46 miles @ 30/- per mile	..	1,380	
Discharge runs—lump sum	..	10,000	47,100
<i>Sidhnai and Abdul Hakim Canals.</i>			
New boundary pillars 36 miles @ Rs. 120/- per mile	..	4,320	
New distance marks 36 miles @ Rs. 200/- per mile	..	7,200	
New bench marks 36 miles @ Rs. 30/- per mile	..	1,080	
Altering distance marks 49 miles @ Rs. 25/- per mile.	..	1,225	
Additional bench marks 49 miles @ Rs. 10/- per mile.	..	490	
Discharge runs lump sum	..	8,500	22,815
<i>Multan Branch (Non-Perennial).</i>			
New boundary pillars 47 miles @ Rs. 120/- per mile	..	5,640	
New distance marks 47 miles @ Rs. 200/- per mile	..	9,400	
New bench marks 47 miles @ 50/- per mile	..	1,410	
Altering distance marks 23 miles @ Rs. 25/- per mile	..	575	
Additional bench marks 23 miles @ Rs. 10/- per mile.	..	230	
Discharge runs—lump sum	..	7,500	24,755
Total		..	94,670
Total O—Miscellaneous		.. say,	95,000

P.—MAINTENANCE.

1% of I—Works (2) Main Canals and Branches less		
B—Land plus P—Maintenance and Unforeseen, <i>i.e.</i>		
$\frac{1}{100} \times 72,89,000 = 72,890$, say	73,000	73,000

UNFORESEEN.

Lump sum	2,00,000	2,00,000
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UNIT No. 3—LEFT BANK CANALS—*contd.*

I—WORKS (3) DISTRIBUTARIES.

Classification of areas.	Gross area in acres.	Rate per acre.	Amount.	Total.
PERENNIAL IRRIGATION.				
<i>Old Areas—</i>		Rs.	Rs.	Rs.
Semi-perennial ..	4,19,848	2/-	8,39,696	
Transferred from inundation canals ..	90,867	2/8	2,27,168	
Total ..	5,10,715		10,66,864	
<i>New Areas—</i>				
Proprietary ..	18,464			
Government rakhs ..	1,54,823			
Proprietary (lift irrigation) ..	10,276			
Total ..	1,83,563	5/-	9,17,815	
NON-PERENNIAL IRRIGATION.				
<i>Old Areas</i> ..	3,12,956	2/8/-	7,82,390	
<i>New areas—</i>				
Proprietary ..	1,35,086			
Government rakhs ..	1,450			
Total ..	1,36,536	5/-	6,82,680	34,49,749
Total I—Works (3) Distributaries			say	34,50,000

I—WORKS (4) DRAINAGE AND PROTECTIVE WORKS.

Particulars.	Amount.	Total.
MAIN CANAL.		
(1) Drains along both banks from R. D. 1,43,600 to R. D. 2,28,250.	Rs.	Rs.
(i) Land. The provision has already been made under the main canal.		
(ii) Earthwork. $2 \times 84,650 \times 22 \times 4 = 1,48,98,400$ cft.		
@ 6/- %	89,390	
Contingencies @ 5%	4,470	
(iii) Bridges. (As estimated)	1,02,000	
Total ..	1,95,860	
(2) Main Outfall Drain—		
(i) Land. Proprietary 450 acres @ 250 per acre	1,12,500	
Crown waste 231.1 acres @ 10 per acre	2,311	
(ii) Bridges. (As estimated)	78,000	
(iii) Earthwork. 7,45,89,350 cft. @ 6%	4,47,000	
Contingencies 5%	22,350	
Total ..	6,62,161	
SIDHNAI CANAL.		
(3) Sukh Beas Drainage—		
(i) Land. Proprietary 674.6 acres @ 250/- per acre	1,68,650	
Crown waste 513.4 acres @ 10/- per acre	5,134	
(ii) Bridges and Falls. (As estimated)	1,23,000	
(iii) Earthwork. 4,50,24,910 cft. @ Rs. 5-8-%	2,47,637	
Contingencies 5%	12,382	
Total ..	5,56,803	14,14,824
Total I—Works (4) Drainage and Protective Works ..	say,	14,15,000

APP. B-II

UNIT No. 3—LEFT BANK CANALS—*contd.*

I—WORKS (5) WATERCOURSES.

Classification of areas.	Gross Area in acres.	Rate per acre.	Amount.	Total.
PERENNIAL IRRIGATION.			Rs.	Rs.
<i>Old Areas</i>	4,19,848			
Transferred from inundation canals ..	90,867			
Total ..	5,10,715	0/2/0	63,839	
<i>New Areas.</i> Proprietary ..	18,464			
Government rakhs ..	1,54,823			
Proprietary (lift irrigation) ..	10,276			
Total ..	1,83,563	2/0/0	3,67,126	
NON-PERENNIAL IRRIGATION.				
<i>Old Areas</i> ..	3,12,956	0/2/0	39,120	
<i>New Areas.</i> Proprietary ..	1,35,086			
Government rakhs ..	1,450			
Total ..	1,36,536	2/0/0	2,73,072	7,43,157
Total I—Works (5) Watercourses ..			say,	7,43,000.

I—WORKS (6) SPECIAL TOOLS AND PLANT.

Particulars.	Amount.	Total.
	Rs.	Rs.
It is proposed to purchase from Bahawalpur 2 second-hand 24 Bucyrus Diesel electric excavators of 4½ cubic yard bucket capacity. The listed price of these machines is 45,000/- each, but they will require extensive overhauls and carriage to site of work, and the total cost of each machine will be about 1 lac. Two machines @ Rs. 1,00,000 each=2,00,000. No re-sale value has been allowed for these machines and the rate of earthwork done on main canal by excavators will be up to Rs. 7/4/-% plus cost of machines ..	2,00,000	
An additional allowance of Rs. 2,00,000 has been made for one large-sized new excavator if required ..	2,00,000	4,00,000
Total I—Works (6) Special Tools and Plant ..		4,00,000

I—WORKS (7) LOSSES ON STOCK.

Lump sum ..	10,000	10,000
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UNIT No. 3—LEFT BANK CANALS—*concl'd.*

II—ESTABLISHMENT.

Particulars.	Amount.	Total.
	Rs.	Rs.
(a) Establishment @ 18 % of I—Works $= \frac{18}{100} \times 1,47,56,000$	26,56,080	
(b) Leave salary @ 6.5% of (a) Establishment $= \frac{6.5}{100} \times 26,56,080$	1,72,645	
(c) Pensionary charges @ 7 % of (a) Establishment plus (b) Leave salary $= \frac{7}{100} \times 28,08,725$..	1,98,011	30,26,736
Total II—Establishment ..	say	30,27,000

III—TOOLS AND PLANT.

2% of I—Works, i.e., of Rs. 1,47,56,000 ..	2,95,120	say, 2,95,000
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IV—SUSPENSE.

Nil.

V—RECEIPTS ON CAPITAL ACCOUNT.

(1) Rent recoveries, etc.— 2/3rd of interest on capital cost of residential buildings @ 6 % per annum for 6 years $= \frac{2}{3} \times \frac{1,81,800 \times 6 \times 6}{100}$	43,632	
(2) 88% of I—Works (5) Watercourses (the remaining 12% is considered to be not recoverable on account of bad debts, etc.) $= \frac{88}{100} \times 7,43,000$..	6,53,840	6,97,472
Total V—Receipts on Capital Account ..	say,	6,97,000

VI—INDIRECT CHARGES.

(1) Capitalization of abatement of land revenue @ 5% of land $= \frac{5}{100} \times 11,76,000$	58,800	say, 59,000
(2) Audit charges @ 1% on I—Works, i.e., of 1,47,56,000	1,47,560	say, 1,48,000
Total VI—Indirect Charges ..	..	2,07,000

Arr. B-II

UNIT No. 4—RANGPUR CANAL.

Abstract of Cost.

Heads of Classification.					Amount.
"Direct Charges."					
I—Works (2)	Main Canal and Branches—				Rs.
	A. Preliminary	..	..	..	15,000
	B. Land	..	..	..	5,46,000
	D. Regulator	..	..	..	..
	E. Falls	..	..	..	1,76,000
	F. River and hill torrents	..	..	..	..
	F (1). Cross drainage works	..	..	..	1,00,000
	G. Bridges	..	..	..	4,40,000
	H. Escapes	..	..	..	..
	I. Navigation works	..	..	..	..
	J. Mills	..	..	..	..
	K. Buildings	..	..	..	2,63,000
	L. Earthwork	..	..	..	26,36,000
	L (1). Service and boundary roads	..	..	..	19,000
	M. Plantation	..	..	..	6,000
	O. Miscellaneous	..	..	..	44,000
	P. Maintenance	..	..	..	37,000
	Unforeseen	..	..	..	2,00,000
I—Works (2) Main Canal and Branches (Total)					44,82,000
I—Works (3) Distributaries					16,48,000
I—Works (4) Drainage and Protective Works					..
I—Works (5) Water-courses					5,39,000
I—Works (6) Special Tools and Plant					1,00,000
I—Works (7) Losses on Stock					10,000
I—Works (Total)					67,79,000
II—Establishment					13,91,000
III—Tools and Plant @ 2% of I—Works					1,36,000
IV—Suspense					..
Total I to IV					83,05,000
V—Receipts on Capital Account					—4,94,000
Total "Direct Charges"					78,12,000
"Indirect Charges."					
VI—(1) Capitalization of abatement of land revenue @ 5% of B—Land					27,000
(2) Audit Charges 1% of I—Works					68,000
Total VI—Indirect Charges					95,000
Total II to VI					11,23,000
GRAND TOTAL, Rangpur canal					79,07,000

UNIT No. 4—RANGPUR CANAL.
I—WORKS (2) MAIN CANAL AND BRANCHES.
A—PRELIMINARY.

Particulars.	Amount.	Total.
Lump sum ..	Rs. 15,000	Rs. 15,000

B—LAND.

Classification of land.	Area.	Rate per acre.	Amount.	Total.
	acres.	Rs.	Rs.	Rs.
Proprietary	2,378	200/-	4,75,600	
Crown waste	712	10/-	7,120	
Thal desert	1,259	50/-	62,950	5,45,670
Total B—Land			say,	5,46,000

D—REGULATORS.

Particulars.	Amount.	Total.
	Rs.	Rs.
Head regulator included in Trimmu headworks ..	Nil.	Nil.

E—FALLS.

Combined falls and bridges at R. D. 9,000, 91,000, 107,000, 142,000, 172,000, 190,000, 222,000, 250,000, 281,000, 310,000, 376,000, 434,000 (proportional cost as estimated) ..	1,75,761	1,75,761
Total E—Falls	say,	1,76,000

F—RIVER AND HILL TORRENT WORKS.

Nil.

F—(I) CROSS DRAINAGE WORKS.

Lump sum	1,00,000	1,00,000
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G—BRIDGES.

Bridges at R. D. 9000, 13000, 18000, 25000, 32500, 38500, 49000, 60000, 71000, 81000, 91000, 99000, 107000, 117000, 126000, 135500, 142000, 154000, 165500, 172000, 181000, 190000, 196000, 206000, 214000, 222000, 233000, 243000, 250000, 261000, 275000, 284000, 296000, 307000, 316000, 326000, 336000, 346000, 356000, 366000, 376000, 387000, 403000, 419000, 434000, 445000, 455000, 466000 (as estimated) ..	4,40,203	4,40,203
Total G—Bridges	say,	4,40,000

APP. B-II

UNIT No. 4—RANGPUR CANAL—contd.

H—ESCAPES.

Nil.

I—NAVIGATION WORKS.

Nil.

J—MILLS.

Nil.

K—BUILDINGS.

Item No.	Classification of buildings.	Particulars.	Amount.	Total.
			Rs.	Rs.
1	Permanent	Executive Engineer's bungalow	22,000	
2	Do.	Executive Engineer's office	8,000	
3	Do.	Sub-Divisional Officer's bungalow	13,600	
4	Do.	Sub-Divisional Officer's office	3,000	
5	Temporary.	Sub-Divisional Officer's bungalows 2 Nos.	20,000	
6	Do.	Sub-Divisional Officer's office	2,500	
7	Do.	Junior Clerks quarters 6 No.	7,200	
8	Permanent.	Subordinate quarters 9 No.	27,000	
9	Do.	Zilladar's quarters 3 No.	12,000	
10	Do.	Rest houses main line 2 No.	31,000	
11	Do.	Rest houses distributaries 4 No.	60,000	
12	Do.	Gauge readers quarters 8 No.	6,100	
13	Do.	Beldars quarters 16 No.	12,800	
14	Do.	Mistris quarters 2 No.	2,400	
15	Temporary.	Godowns 4 No.	8,000	
16	Permanent.	Telegraph offices 2 No.	6,000	
17	Do.	Dispensary	6,000	2,50,900
18		Unforeseen @ 5/- %	12,515	2,63,415
Total K—Buildings			say,	2,63,000

L—EARTHWORK.

REACH.		Total quantities (cft.)	Rate %/100 (cft)	Amount.	Total.
From R. D.	To R. D.				
			Rs.	Rs.	Rs.
0	9,000	2,11,06,100	10/-	2,11,061	
9,000	2,84,000	17,53,00,000	5/8	9,61,150	
2,84,000	3,21,000	1,63,48,900	5/8	89,919	
3,24,500	3,76,000	7,97,30,700	7/-	5,58,115	
3,76,000	4,08,500	1,50,33,300	5/8	82,683	
4,08,500	4,61,500	6,94,58,200	7/-	4,86,207	
4,61,500	4,72,000	42,29,300	5/8	23,261	24,15,396
Contingencies @ 5% -				1,20,770	25,36,166
Add for raising of left bank		Lump sum		1,00,000	26,36,166
Total L.—Earthwork				say	26,36,000

UNIT No. 4—RANGPUR CANAL—*continued*.

L (I).—SERVICE-AND BOUNDARY ROADS.

Particulars.	Amount.	Total.
94.5 miles @ Rs. 200 a mile	Rs. 18,900 say	Rs. 19,000

M—PLANTATION.

Lump sum	6,000	6,000
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O—MISCELLANEOUS.

(1) Boundary pillars 94.5 miles @ Rs. 120 a mile	11,540	
(2) Distance marks 94.5 miles @ Rs. 200 a mile	18,900	
(3) Bench marks 94.5 miles @ Rs. 30 a mile	2,835	
(4) Discharge runs—lump sum	8,000	
(5) Unforeseen	2,500	43,575
Total O—Miscellaneous	say,	44,000

P—MAINTENANCE.

1% of Total I—Works (2) Main Canal and Branches less B—Land plus P—Maintenance and Unforeseen, i.e., of Rs. 36,99,000	36,990	36,990
Total P—Maintenance	say,	37,000

UNFORESEEN.

Lump sum	2,00,000	2,00,000
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I—WORKS (3) DISTRIBUTARIES.

Classification of areas.	Gross area in acres.	Rate per acre.	Amount.	Total.
<i>Old areas</i>		Rs. 2/8/-	Rs. 2,67,910	Rs.
<i>New areas</i> —Proprietary	1,07,164			
Government rakhs	2,42,619			
	20,327			
Total	2,62,946	5/4/-	13,80,467	16,48,377
Total I—Works (3) Distributaries		say,		16,48,000

I—WORKS (4) DRAINAGE AND PROTECTIVE WORKS.

Nil.

I—WORKS (5) WATERCOURSES.

<i>Old areas</i>	1,07,164	-/2/-	13,396	
<i>New areas</i> —Proprietary	2,42,619			
Government rakhs	20,327			
Total	2,62,946	2/-	5,25,892	5,39,288
Total I—Works (5) Watercourses		say,		5,39,000

APP. B-II

UNIT No. 4—RANGPUR CANAL—*contd.*
I—WORKS (6) SPECIAL TOOLS AND PLANT.

Particulars.	Amount.	Total.
	Rs.	Rs.
Lump sum ..	1,00,000	1,00,000

I—WORKS (7) LOSSES ON STOCK.

Lump sum ..	10,000	10,000
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II—ESTABLISHMENT.

(a) Establishment @ 18% of I—Works—Total, <i>i.e.</i> , of Rs. 67,79,000 ..	12,20,220	
(b) Leave salary @ 6.5% of (a) Establishment $= \frac{6.5}{100} \times 12,20,220$..	79,311	
(c) Pensionary charges @ 7% of (a) Establishment plus (b) Leave salary $\frac{7}{100} \times 12,99,534$..	90,967	13,50,501
Total II—Establishment ..	say.	13,91,000

I—WORKS III—TOOLS AND PLANT.

2% of I—Works—Total, <i>i.e.</i> , of Rs. 67,79,000 ..	1,35,580	1,35,580
Total III—Tools and Plant ..	say.	1,36,000

IV—SUSPENSE.

Nil

V—RECEIPTS ON CAPITAL ACCOUNT.

(1) Rent recoveries, etc. ..	20,000	
(2) 88% of I—Works (5) Watercourses (the remaining 12% is considered to be not recoverable on account of bad debts) $= \frac{5,39,000 \times 88}{100}$..	4,74,320	4,94,320
Total V—Receipts on Capital Account ..	say,	4,94,000

VI—INDIRECT CHARGES.

(1) Capitalization of abatement of land revenue @ 5% of land $= \frac{5 \times 5,40,000}{100}$..	27,300	say, 27,000
(2) Audit charges 1% of Total—I—Works, <i>i.e.</i> , Rs. 67,79,000 $\times \frac{1}{100}$..	67,790	say, 68,000
Total Indirect Charges ..	..	95,000

UNIT No. 5—MONTGOMERY-PAKPATTAN LINK

Abstract of Cost

Heads of Classification.					Amount.
					Rs.
" Direct Charges "					
I.—Works (2) Main Canal and Branches	..	..	..	..
A.—Preliminary	..	..	..	..	6,000
B.—Land	..	..	..	..	1,67,000
D.—Regulators	..	..	..	..	23,000
E.—Falls	..	..	..	..	31,000
F.—River and hill torrent works	..	..	..	..	..
F. (1)—Other cross-drainage works	..	..	..	..	53,000
G.—Bridges	..	..	..	..	1,05,000
K.—Buildings	..	..	..	..	20,000
L.—Earthwork	..	..	..	..	2,63,000
L. (1)—Service and boundary roads	..	..	..	..	6,000
L. (2)—Lining	..	..	..	..	77,000
M.—Plantation	..	..	..	..	6,000
O.—Miscellaneous	..	..	..	..	1,25,000
P.—Maintenance	..	..	..	..	7,000
Unforeseen	..	..	..	..	75,000
I.—Works (2) Main Canal and Branches—(Total)	..	..	..	..	9,64,000
I.—Works (3) Distributaries	..	..	..	..	..
I.—Works (4) Drainage and Protective Works	..	..	..	..	..
I.—Works (5) Water-courses	..	..	..	..	..
I.—Works (6) Special Tools and Plant	..	..	..	..	..
I.—Works (7) Losses on Stock	..	..	..	..	..
I.—Works (Total)	..	..	..	..	9,64,000
II.—Establishment	..	..	..	..	1,98,000
III.—Tools and Plant @ 2% of I.—Works	..	..	..	..	19,000
IV.—Suspense	..	..	..	..	..
Total I—IV	..	..	..	..	11,81,000
V.—Receipts on Capital Account	..	..	..	..	—3,000
Total Direct Charges	..	..	..	..	11,78,000
" Indirect Charges "					
VI.—(1) Capitalization of abatement of Land Revenue @ 5 % of land	..	..	..	..	8,000
(2) Audit Charges @ 1 % of I.—Works	..	..	..	..	10,000
Total " Indirect Charges "	..	..	..	..	18,000
Total II to VI	..	..	..	..	2,32,000
GRAND TOTAL " Direct and Indirect Charges "	..	..	..	..	11,86,000

APP. B-II

UNIT No. 5—MONTGOMERY-PAKPATTAN LINE—*cont'd.*

I.—Works (2) MAIN CANAL AND BRANCHES

A.—PRELIMINARY.

Particulars	Amount.	Total.
	Rs.	Rs.
Aligning and levelling, etc., 30 miles @ Rs. 200 per mile	6,000	6,000

B.—LAND.

Classification of land.	Area of land	Rate per acre.	Amount.	Total.
	acres.	Rs.	Rs.	Rs.
(1) Lower Bari Doab canal colony land	153.00	500/-	76,500	
(2) Non-perennial Crown waste land on Dipalpur canal ..	104.23	12/-	1,251	
(3) Non-perennial proprietary area on Nurpur distributary ..	102.73	300/-	30,819	
(4) Pakpattan colony land ..	194.34	300/-	58,302	1,66,872
Total B—Land		say		1,67,000

D.—REGULATORS.

Particulars.	Amount.	Total.
	Rs.	Rs.
(1) Head regulator of Feeder channel ..	12,600	
(2) Tail inlet ..	10,000	22,600
Total D.—Regulators	.. say	23,000

E.—FALLS.

4 No. Falls @ Rs. 7,670 each (as estimated)	30,680	30,680
Total E.—Falls	.. say	31,000

F.—RIVER AND HILL TORRENT WORKS.

Nil

F. (1)—OTHER CROSS DRAINAGE WORKS.

(1) Sukh Beas syphon (as estimated)	21,600	
(2) Syphon for Channi minor (as estimated)	5,000	
(3) Ladho Wanga distributary syphon (as estimated)	5,400	
(4) Nurpur distributary syphon (as estimated)	15,800	
(5) Kabir distributary syphon (as estimated)	5,400	52,700
Total F (1)—Other Cross-Drainage Works, say		53,000

UNIT No. 5—MONTGOMERY-PAKPATTAN LINK—*contd.*

G.—BRIDGES.

Particulars.	Amount.	Total.
	Rs.	Rs.
(1) Village road bridges, 9 No. @ Rs. 6,250/- each (as estimated)	56,250	
(2) Combined village road bridges and falls, 4 No. @ Rs. 3,830/- each (as estimated)	15,320	
(3) Main (unmetalled) road bridge (as estimated)	9,750	
(4) Main (metalled) road bridge, (as estimated)	11,300	
(5) Main (metalled) road bridge, (as estimated)	10,900	
(6) Lowering floor of railway bridge (as estimated)	1,550	
(7) Lowering floor of road bridge (as estimated)	360	1,05,430
Total G.—Bridges .. say		1,05,000

K.—BUILDINGS.

(1) Subordinates' quarters (permanent) 4 No. ..	12,000	
(2) Bellars quarters' (permanent) 4 No. ..	3,200	
(3) Miscellaneous ..	5,000	20,200
Total K. Buildings .. say		20,000

L.—EARTHWORK.

Particulars.	Quantity	Rate % c.ft.	Amount.	Total.
	c.ft.	Rs	Rs.	Rs.
(1) Constructing Feeder channel ..	4,35,00,000	5/12/-	2,50,125	
(2) Contingencies @ 5/- % ..			12,506	
(3) Remodelling head reach of Ganjibar distributary ..	1,66,000	4/8/-	747	
(4) Contingencies @ 5 % ..			37	2,63,435
Total L.—Earthwork .. say				2,63,000

L (1)—SERVICE AND BOUNDARY ROADS.

Particulars.	Amount.	Total.
	Rs.	Rs.
30 miles @ 200/- per mile ..	6,000	6,000

L (2)—LINING.

(1) Head reach of Ganji Bar distributary (as estimated)	62,900	
(2) Tail reach of Feeder channel (as estimated) ..	13,700	76,600
Total L (2)—Lining .. say		77,000

M.—PLANTATION.

2 lines of avenue 3.0 x 2 = 60 miles @ 100/- per mile	6,000	6,000
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APP. B-II

UNIT No. 5—MONTGOMERY-PAKPATTAN LINK—*contd.*

O.—MISCELLANEOUS.

Particulars.	Amount.	Total.
	Rs.	Rs. --
(1) Boundary pillars 30 miles @ 120/- a mile ..	3,600	
(2) Distance marks 30 miles @ 200/- a mile ..	6,000	
(3) Bench marks 30 miles @ 30/- a mile ..	900	
(4) Discharge runs lump-sum ..	10,000	
(5) Linking water-courses 14 miles @ 400/- per mile ..	5,600	
(6) Water-course crossings 8 No. @ 1,500/- each ..	12,000	
(7) Making outlet between Feeder regulator and minor of Ganji Bar distributary L.S. ..	1,000	
(8) Making new outlets 10 No. @ 200/- each ..	2,000	
(9) Making road culverts for outlets 8 No. @ 300/- each ..	2,400	
(10) Widening Lower Bari Doab canal as estimated by Superintending Engineer, Lower Bari Doab canal, circle, <i>vide</i> his letter No. 54/C., dated 18-5-35. ..	81,775	1,25,275
Total O—Miscellaneous ..	say	1,25,000

P.—MAINTENANCE.

1 % of Total I.—Works (2) Main Canal and Branches less B. Land plus P. Maintenance and Unforeseen. <i>i.e.</i> of Rs. 7.15,000 ..	7,150	say 7,000
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I.—WORKS (3) DISTRIBUTARIES.

Nil.

I.—WORKS (4) DRAINAGE AND PROTECTIVE WORKS.

Nil.

I.—WORKS (5) WATER-COURSES.

Nil.

I.—WORKS (6) SPECIAL TOOLS AND PLANT.

Nil.

I.—WORKS (7) LOSSES ON STOCK.

Nil.

II.—ESTABLISHMENT.

(a) Establishment @ 18 % of I.—Works (Total) $= \frac{18}{100} \times 9,64,000$	1,73,520	
(b) Leave salary @ 6.5 % of (a) Establishment $= \frac{6.5}{100} \times 1,73,520$..	11,279	
(c) Pensionary charges @ 7 % of (a) Establishment plus (b) Leave salary $= \frac{7}{100} \times 1,84,799$..	12,936	1,97,735
Total II—Establishment ..	say	1,98,000

III—TOOLS AND PLANT.

2 % of I.—Works (Total) $= \frac{2}{100} \times 9,64,000$..	19,280	19,280
Total III—Tools and Plant ..	say	19,000

IV.—SUSPENSE.

Nil

UNIT No. 5—MONTGOMERY-PAKPATTAN LINK—*concl'd.*

V.—RECEIPTS ON CAPITAL ACCOUNT.

Particulars.	Amount.	Total.
	Rs.	Rs.
(1) Receipts from sale of ordinary tools and plant, 10% of III.—Tools and plant, <i>i.e.</i> , of 19,000/- ..	1,900	
(2) Receipts from rent from subordinate quarters lump-sum ..	1,000	2,900
Total V—Receipts on Capital Account ..	say	3,000

VI.—INDIRECT CHARGES.

(1) Capitalization of abatement of land revenue, 5% of			
B-Land = $\frac{5}{100} \times 1,67,000$	8,350	say	8,000
8 Audit charges, 1% of Total I—Works, <i>i. e.</i> , of 9,64,000	9,640	say	10,000
Total " Indirect Charges " .. .			18,000

APPENDIX B-III.
ANALYSES OF RATES.

APPENDIX B-III (a).

ANALYSES OF RATES FOR HEADWORKS.

(1) Stone for pitching per 100 cft.				Rs.
25,080 cft. at quarry siding at 12/- % cft.	..	..	..	3,010
Haulage on quarry railway	..	..	..	500
Freight N. W. Railway for 122 miles at 9/- per mile including the empty return journey	...	..	..	1,098
	..	Total	..	4,608
Cost of 100 cft. at N. W. Railway junction	..	..	..	18.4
Carriage on canal railway to dump 15 miles at -/12/- per truck per mile (418 cft. per truck) including the empty return journey and unloading $(2.7+0.5)=3.2$	..	..	..	3.2
		Total	..	21.6
Cost at dump, say, Rs. 21/8/-				
Reloading in B. G. trucks	..	..	..	0.6
Supervision	..	..	..	0.2
Carriage to rail-head at 1/8/- per truck (300 cft. per truck), including the empty return journey	..	..	..	0.5
Unloading	..	..	..	0.5
		Total	..	23.4
Cost at rail-head, say, Rs. 23/8/-				
Carriage by hand to site (average lead 3 chains) ..	..	..	..	1.5
		Total	..	24.9
Cost of 100 cft. at site, say, Rs. 25/-				
(2) Building stone (face work) per 100 cft.				
25,080 cft. at quarry siding at 17/- % cft.	..	..	..	4,261
Haulage on quarry railway	..	..	..	500
Freight N. W. Railway for 122 miles at 9/- per mile, including the empty return journey	..	..	..	1,098
		Total	..	5,862
Cost of 100 cft. at N. W. Railway junction	..	..	..	23.4
Carriage on canal railway to dump 15 miles at -/12/- per truck per mile (418 cft. per truck), including the empty return journey	..	..	..	2.7
Unloading	..	..	..	0.75
		Total	..	26.85
Cost at dump, say, Rs. 26/13/-				
Reloading in B. G. trucks	..	..	..	0.75
Supervision	..	..	..	0.2
Carriage to rail-head at 1/8/- per truck (300 cft. per truck), including the empty return journey	..	..	..	0.5
Unloading	..	..	..	0.75
		Total	..	29.05
Cost at rail-head, say, Rs. 29/-				
Carriage by hand to site (average lead 3 chains) ..	..	..	..	1.50
		Total	..	30.55
Cost of 100 cft. at site, say, Rs. 30/8/-				
(3) Building Stone (Hearting) per 100 cft.				
Rs. 3/12/- less than for facing stone				
Cost at rail-head $(29/- - 3/12/-) = 25/4/-$	..	..	..	25.25
Carriage by hand to site as above	..	..	..	1.50
		Total	..	26.75
Cost of 100 cft. at site, say, Rs. 26/12/-				
(4) Building stone (Ashlar) per 100 cft.				
18,000 cft. at quarry siding at 1/8/- cft.	..	..	..	27,000
Haulage on quarry railway	..	..	..	500
Freight N. W. Railway for 122 miles at 9/- per mile	..	..	..	1,098
		Total	..	28,598

APP. B-III (a)

	Rs.
<i>Building stone (Ashlar) — contd.</i>	
Cost of 100 cft. at N. W. Railway junction, say, Rs. 160/- ..	160.00
Carriage on canal railway to dump 15 miles at -/12/- per truck per mile (412.5 cft. per truck), including the empty return journey ..	3.60
Unloading	3.00
Reloading in B. G. trucks	5.00
Supervision	0.20
Carriage to rail-head at 1/12/- per truck (210 cft. per truck), including the empty return journey	6.83
Unloading	3.00
Total	175.63
Cost of 100 cft., say, Rs. 175/10/-	
(5) <i>Spawls per 100 cft.</i>	
25,080 cft. at quarry siding at 4/- % cft.	1,003
Haulage on quarry railway	500
Freight N. W. Railway for 122 miles at 9/- per mile including the empty return journey	1,098
Total	2,601
Cost for 100 cft. at N. W. Railway junction	10.37
Carriage on canal railway to dump 15 miles at -/12/- per truck per mile (418 cft. per truck), including the empty return journey ..	2.70
Unloading	0.50
Total	13.57
Cost at dump, say, Rs. 13,9/-	
Reloading on B. G. trucks	6.75
Supervision	0.20
Carriage to rail-head at Rs. 1/8/- per truck (300 cft. per truck), including the empty return journey	0.50
Unloading	0.50
Total	15.52
Cost at rail-head, say, Rs. 15,8/-	
Carriage by hand to site (average lead 3 chains)	1.50
Total	17.02
Cost of 100 cft. at site, say, Rs. 17/-	
(6) <i>Granulated stone ballast (crushed locally) per 100 cft.</i>	
110 cft. spawls at Rs. 13,9/- % cft. at dump	14.92
100 cft. breaking at 4/- % cft. (including labour, erection of platforms, plant and power lines also power supervision and loading on B. G. trucks)	4.60
Carriage to rail-head at 1,8/- per truck (300 cft. per truck), including the empty return journey	0.50
Unloading on mixer platform	0.80
Total	20.22
Cost at rail-head, say, Rs. 20,4/- % cft.	
Carriage by hand to site (average lead 3 chains)	1.50
Total	21.72
Cost of 100 cft. at site, say, Rs. 22/-	
(7) <i>Cement per 100 cft.</i>	
Cost for one ton F. O. R.	33.00
Bagging	3.50
Wastage of bags	0.50
Railway-freight to N. W. Railway junction	8.31
Carriage on canal railway to godown distance 15 miles at -/12/- per truck per mile (20 tons per truck), including the empty return journey ..	0.56
Unloading in godown	0.50
Loading on B. G. trucks	0.50
Carriage to rail-head at 1/8/- per truck (15 tons per truck) including the empty return journey	0.10
Unloading	0.25
Total cost for one ton at canal rail-head	47.22

Cement—(contd.)				Rs.
Cost per 100 cft. (at 90 lbs. per cft.)	..	..	..	189.72
Carriage by hand to site (average lead 3 chains)	..	..	..	2.26
Total				191.98
Cost for 100 cft., say, Rs. 192/-				
(8) Graded sand per 100 cft at site Rs. 5/-				
(9) White lime per maund.				
Cost F. O. R. at Khushab railway station	..	..	..	0.75
Railway freight average distance 200 miles	..	..	..	0.45
Unloading and stacking charges	..	..	..	0.04
Wastage of gunny bags	..	..	..	00.1
Carriage from railway station to site (average distance 3 miles)	..	..	..	0.09
Total				1.34
Say, Rs. 1/6/-				
(10) Surkhi per 100 cft.				
Cost at kiln site	..	..	..	17.00
Carriage to site : average distance 3 miles ($1/12 + 1/6 + 1/2$) = $1/4$/-	..	..	..	4.25
Total				21.25
Say, Rs. 21/4/-				
(11) Bricks pucca per 1,000 Nos.				
Cost of bricks at kiln	..	..	..	15.00
Carriage to dump (average distance 3 miles)	..	..	..	4.25
Carriage to site at 1/8/- %	..	..	..	1.50
Total				20.75
Say, Rs., 20/12/-				
(12) Brick ballast per 100 cft.				
Cost of bricks 800 No. at 20/12/- %	..	..	..	16.60
Breaking charges at 2.25 % cft.	..	..	..	2.25
Total				18.85
Say Rs. 19/- % cft.				
(13) Steel—per cwt.				
Steel for reinforcement per cwt.	..	..	..	16/-
Steel for bearing plates, angle iron, mild steel sections, etc., per cwt.	..	..	..	14.00
R. S. Beams for bridges per cwt.	..	..	..	12.00
(14) Gas Pipes—one lft.				-/8/-
(15) Lime Mortar per 100 cft.				
White lime 17 maunds at Rs. 1.34 per maund	..	..	..	22.78
Surkhi 73 cft. at Rs. 21.25 % cft.	..	..	..	15.51
Labour charges	..	..	..	2.50
Total				40.79
Say, Rs. 40/13/0 % cft.				
(16) Pucca brick Masonry per 100 cft.				
Bricks 1150 No. at 20/12/- %	..	..	..	23.85
Lime mortar 25 cft. at 40.79/- % cft.	..	..	..	10.20
Labour charges	..	..	..	8.50
Total				42.55
Say, Rs. 42/8/- % cft.				
(17) Lime concrete per 100 cft.				
Brick ballast 110 cft. at 19/- % cft.	..	..	..	20.90
Lime mortar 40 cft. at 40.79/- % cft.	..	..	..	16.32
Labour charges	..	..	..	5.25
Total				42.47
Say, Rs. 42/8/- % cft.				
(18) Dry Brick Pitching per 100 cft.				
Bricks 1150 No. at 20/ 12/ %	..	..	..	23.86
Labour charges	..	..	..	3.75
Total				27.61
Say Rs. 28/- % cft.,				

APP. B-III (a)

					Rs.
(19) <i>Dry Brick Ballast per 100 c.ft.</i>					
Brick ballast 100 cft. at 19/- % cft	..	..	..	..	19-0
Labour charges	..	..	..	..	1-25
				Total	20-25
				Say, Rs. 20/8/- % cft.	
(20) <i>Cement Concrete (1 : 2 : 4) per 100 cft.</i>					
Cement 22-5 cft. at 192/- % cft.	..	..	..	..	43-20
Sand-graded 45 cft. at 5/- % cft.	..	..	..	..	2-25
Graded stone ballast 90 cft at 22/- %	..	..	..	..	19-80
Labour charges	..	..	..	..	4-50
Other charges	..	..	..	..	5-00
				Total	74-75
				Say, Rs. 75/- % cft.	
(21) <i>Cement Concrete (1 : 3 : 6) per 100 cft.</i>					
Cement 18 cft. at 192/- % cft.	..	..	..	..	30-72
Sand graded 48 cft. at 5/- % cft.	..	..	..	..	2-40
Graded stone ballast 95 cft. at 22/- % cft.	..	..	..	..	20-90
Labour charges	..	..	..	..	4-50
Other charges	..	..	..	..	5-00
				Total	63-52
				Say, Rs. 64/- % cft.	
(22) <i>Cement Concrete (1 : 4 : 8) per 100 cft.</i>					
Cement 12 cft. at 192/- % cft.	..	..	..	..	23-04
Sand graded 48 cft. at 5/- % cft.	..	..	..	..	2-40
Graded stone ballast 98 cft. at 22/- % cft.	..	..	..	..	21-56
Labour charges	..	..	..	..	4-50
Other charges	..	..	..	..	5-00
				Total	56-50
				Say, Rs. 57/- % cft.	
(23) <i>Reinforced Cement Concrete per 100 cft.</i>					
Cement 22-5 cft. at 192/- % cft.	..	..	..	..	43-20
Graded sand 45 cft. at 5/- % cft.	..	..	..	..	2-25
Graded stone ballast 90 cft. at 22-0 % cft.	..	..	..	..	19-80
Extra charges for breaking fine ballast	..	..	..	..	2-00
Labour charges L. S.	..	..	..	..	33-00
				Total	100-25
				Say, Rs. 100/- % cft.	
(24) <i>Centring per 100 sft.</i>					
For slab bridges 1/4/- per sft.	..	..	..	..	25/-
(25) <i>Centring per 100 sft.—for flume at 1/8/- sft.</i>					50/-
(26) <i>Metalling per 100 cft. (brick ballast).</i>					
Brick ballast 110 cft. at 19/- % cft.	..	..	..	..	20-90
Labour charges	..	..	..	..	3-00
				Total	23-90
				Say, Rs. 24 % cft.	
(27) <i>Cement Mortar (1 : 3) per 100 cft.</i>					
Cement 33-33 cft. at 192/- % cft.	..	..	..	..	64-00
Graded sand 100 cft. at 5/- % cft.	..	..	..	..	5-00
Labour charges	..	..	..	..	3-00
				Total	72-00
				Say, Rs. 72/- % cft.	
(28) <i>Brick Masonry in Cement per 100 cft.</i>					
Pacca bricks 1150 No. at 20/12/- % cft.	..	..	..	..	23-86
Cement mortar 25 cft. at 72/- %	..	..	..	..	18-00
Labour charges	..	..	..	..	8-00
				Total	50-36
				Say, Rs. 50/8/- % cft.	

				Rs.
(29) <i>Stone Masonry in cement per 100 cft.</i>				
Hearting stone 110 cft. at 26·75/- % cft.	..	..	..	29·43
Facing stone 45 cft. at 30/8/- % cft.	..	..	..	13·73
Cement mortar 45 cft. at 72/- % cft.	..	..	..	32·40
Labour charges	..	..	..	12·00
Scaffolding L. S. 1/- %	..	..	..	1·00
			Total	88·56
			Say, Rs. 89/- % cft.	
(30) <i>Dry Stone Pitching per 100 cft.</i>				
Stone 110 cft. at 25/- % cft.	..	..	..	27·50
Labour charges and packing, etc.	..	..	..	5·00
			Total	32·50
			Say, Rs. 33/- % cft.	
(31) <i>Grouted Stone Pitching per 100 cft.</i>				
Stone 110 cft. at 25/- % cft.	..	..	..	27·50
Labour charges	..	..	..	5·00
Cement mortar 40 cft at 72/- % vide item (27)	..	..	..	28·80
			Total	61·30
			Say Rs. 61/8/- % cft	
(32) <i>Stone Spawls filling per 100 cft.</i>				
Spawls 100 cft. at 17/- %	..	..	..	17·00
Labour charges	..	..	..	3·00
			Total	20·00
			% cft	
(33) <i>Cement Concrete Blocks (1 : 4 : 8) per 100 cft.</i>				
Cement concrete at 57/- %	..	..	..	57·00
Mixing and placing	..	..	..	5·50
Other charges, etc.	..	..	..	3·00
Placing by baskets	..	..	..	0·50
Cost of moulds, etc.	..	..	..	1·00
Placing, greasing and dismantling moulds	..	..	..	1·00
			Total	68·00
			% cft	
(34) <i>Bat Soling per 100 cft.</i>				
800 bricks at Rs. 20/12/- %o	..	..	..	16·60
Labour	..	..	..	3·75
			Total	20·35
			Say, Rs. 20/8/- % cft.	
(35) <i>Reinforced Concrete in Well Curbs per 100 cft.</i>				
100 cft. at 2/4/- cft.	..	..	..	225/-
(36) <i>Stone Filling in Trangars per 100 cft.</i>				
(i) Stone 100 cft. at 25/- % cft.	..	..	..	25·00
(ii) Filling charges 100 cft.	..	..	..	2·00
Extra for trangars at 1/- %	..	..	..	1·00
			Total	28·00
			% cft.	
(37) <i>Stone Filling per 100 cft.</i>				
Items (i) + (ii) of stone filling in trangars	..	..	..	Rs. 27/- %
(38) <i>Fine Stone Bajji Filling per 100 cft.</i>				
Graded stone ballast 100 cft. at 22/-	..	..	..	22·00
Labour charges	..	..	..	2·00
			Total	24·00
			% cft.	

APP. B-III (a)

				Rs.
(39) Hammer Dressing in Stone Masonry.	-			
100 sft at -/2/- sft	..	..	..	12/8/-
(41) Chisel Dressing in Stone Masonry.				
100 sft at -/12/- sft	..	..	..	75/-
(11) Labour for fitting railings.				
Over bridges, etc., at 4/- cwt.	..	..	..	4/-
(42) Sheet piling per 100 sft @ 3/8/- sft	..	..	..	350/-
(43) Centring for Arches of Head Regulator.				
100 sft at -/3/- sft	..	..	..	18/12/-
(44) Well Sinking.				
Per lineal foot	..	..	..	12/-
(45) Sand Filling per 1000 cft from river bed.				
With 100' lead	..	..	..	5/- %
(46) Earthwork per 1000 cft.				
From borrow pits, lead 50 ft. 4/4/- %				
From borrow pits, lead 100 ft. 5/- %				
From borrow pits, extra lead -/10/- per chain.				
Damp earthwork where considered necessary, 1/- % cft. extra				
Wet earthwork where considered necessary, 2/- % cft. extra				
Hardness allowance up to 1/- %				
Hutting allowance where necessary, up to -/4/- % cft.				
Note.—Officers should realize that allowances on earthwork rates are not to be added as a matter of course but will have to be justified on local conditions.				
(47) Metalling per 100 cft.				
110 cft. stone ballast at 22/- % cft	..	..	..	24.20
Labour charges	..	..	..	3.00
Total			..	27.20
Say, Rs. 27/4/- % cft.				
(48) Stone ballast under stone pitching 100 cft.				
Stone ballast 100 cft at 22/- %	..	..	..	22.00
Labour charges	..	..	..	1.25
Total			..	23.25
Say, Rs. 23/4/- % cft.				

APPENDIX B-III (b).

ANALYSES OF RATES FOR MAIN CANAL AND BRANCHES.

	Rs.
(1) <i>Cement per 100 cft.</i>	
Cost for one ton F. O. R.	33.00
Bagging	3.50
Wastage of bags	0.50
Railway freight to N. W. Railway junction	8.31
Carriage on canal railway to godown, distance 15 miles at -/12/- per truck per mile (20 tons per truck), including the empty return journey	0.56
Unloading in godown	0.50
Loading on B. G. trucks	0.50
Carriage to rail-head at 1/8/- per truck (15 tons per truck), including the empty return journey	0.10
Unloading	0.25
Total cost for one ton at canal rail-head	47.22
Cost per 100 cft. at 90 lbs. per cft.	189.72
Carriage by hand to site (average lead 3 chains)	2.26
Total	191.98
Cost for 100 cft. say, Rs. 192/-.	
(2) <i>Graded Sand. per 100 cft. at site Rs. 5/-.</i>	
(3) <i>White Lime per maund.</i>	
Cost F. O. R. at Khushab railway station	0.75
Railway freight average distance 200 miles	0.45
Unloading and stacking charges	0.04
Wastage of gunny bags	0.01
Carriage from railway station to site (average distance 3 miles)	0.09
Total	1.34
Say, Rs. 1/6/-.	
(4) <i>Surkhi per 100 cft.</i>	
Cost at kiln site	17.00
Carriage to site (average distance 3 miles) $1/12 + 1/6 + 1/2 = 4/4$ -	4.25
Total	21.25
Say, Rs. 21/4/- cft.	
(5) <i>Bricks pacca per 1,000 No.</i>	
Cost of bricks at kiln	15.00
Carriage to site (average distance 3 miles)	4.25
Total	19.25
Say, Rs. 19/4/- % cft.	
(6) <i>Brick ballast per 100 cft.</i>	
Bricks 800 No. at 19/4/- % cft.	15.40
Breaking charges at 2.25 % cft.	2.25
Total	17.65
Say, Rs. 17/12/- % cft.	
(7) <i>Steel one cwt.</i>	
Steel for reinforcement for slabs, etc.	16.00
Steel for bearing plates, angle iron, mild steel sections, etc., per cwt.	14.00
R. S. Beams for bridges per cwt.	12.00
(8) <i>Gas Pipes—per foot.</i>	-/8/-
(9) <i>Lime Mortar per 100 cft.</i>	
(i) White lime 17 maunds at Rs. 1.34 per maund	22.78
(ii) Surkhi 73 cft. at Rs. 21.25 % cft.	15.51
Total	38.29
say, Rs. 38/4/- % cft.	

APP. B-III (b)

				Rs.
(10) <i>Pacca Brick Masonry per 100 cft.</i>				
Bricks 1,150 No. at 19/4/- % cft.	..	..	..	22-14
Lime mortar 25 cft. at 38-29 % cft.	..	..	..	9-57
Labour charges	..	..	..	8-50
		Total	..	40-21
	Say, Rs. 40/4/-	% cft.		
(11) <i>Lime Concrete per 100 cft.</i>				
Brick ballast 110 cft. at 17-65 % cft.	..	..	..	19-42
Lime mortar 40 cft. at 38-29 % cft.	..	..	..	15-32
Labour charges	..	..	..	5-25
		Total	..	39-99
	Say Rs. 40/-	% cft.		
(12) <i>Cement Mortar (1 : 3) per 100 cft.</i>				
33-33 cft. cement at Rs. 192/- % cft.	..	..	..	64-0
100 cft. sand at Rs. 5/- %	..	..	..	5-0
		Total	..	69-0
(13) <i>Brick Masonry in Cement % cft.</i>				
1,150 No. bricks at 19-25 % cft.	..	..	..	22-14
25 cft. cement mortar at 69/- %	..	..	..	17-25
Labour	..	..	..	8-5
		Total	..	47-89
	Say Rs. 48/-	% cft.		
(14) <i>Dry Brick Pitching per 100 cft.</i>				
Bricks 1,150 No. at 19/4/- % cft.	..	..	..	22-14
Labour charges	..	..	..	3-75
		Total	..	25-89
	Say, Rs. 26/-	% cft.		
(15) <i>Dry Brick Ballast per 100 cft.</i>				
Brick ballast 100 cft. at 17-65 % cft.	..	..	..	17-65
Labour charges	..	..	..	1-25
		Total	..	18-90
	Say, Rs. 19/-	% cft.		
(16) <i>Metalling per 100 cft.</i>				
110 cft. brick ballast at 17-65 % cft.	..	..	..	19-42
Labour	..	..	..	3-00
		Total	..	22-42
	Say, Rs. 22/-	% cft.		
(17) <i>Cement Mortar (1 : 4) per 100 cft.</i>				
25 cft. cement at 192/- % cft.	..	..	..	48/-
100 cft. sand at 5/- % cft.	..	..	..	5/-
		Total	..	53/- %
(18) <i>Cement Concrete (1 : 4 : 11 with brick ballast) per 100 cft.</i>				
40 cft. mortar (1 : 4) at 53/- % cft.	..	..	..	21-2
110 cft. brick ballast at 17-65 %	..	..	..	19-42
Labour charges	..	..	..	5-25
		Total	..	45-87
	Say, Rs. 46/-	% cft.		
(19) <i>Cement Concrete (1 : 2 : 4) per 100 cft.</i>				
Cement 22-5 cft. at 192/- % cft.	..	..	..	43-20
Sand graded 45 cft. at 5/- % cft.	..	..	..	2-25
Graded stone ballast 90 cft. at 22/-	..	..	..	19-80
Labour charges	..	..	..	4-50
Other charges	..	..	..	5-00
		Total	..	74-75
	Say, Rs. 75/-	% cft.		

(20) Cement Concrete (1 : 3 : 6) per 100 cft.					
Cement 16 cft. at 192/- % cft.	..	..	..	..	30.72
Sand graded 48 cft. at 5/- % cft.	..	..	..	..	2.40
Graded stone ballast 95 cft. at 22/- % cft.	..	..	..	..	20.90
Labour charges	..	..	..	..	4.50
Other charges	..	..	..	..	5.00
Total					63.52
Say, Rs. 61/- % cft.					
(21) Reinforced Cement Concrete per 100 cft.					
Cement 22.5 cft. at 192/- % cft.	..	..	..	..	43.20
Graded sand 45 cft. at 5/- % cft.	..	..	..	..	2.25
Graded stone ballast 90 cft. at 22.0 % cft.	..	..	..	..	19.80
Extra charges for breaking fine ballast	..	..	..	..	2.00
Labour charges L. S.	..	..	..	..	33.00
Total					100.25
Say, Rs. 100/- % cft.					
(22) Centring per 100 sqt.					
For slab bridges per sqt. -/4/-	..	..	..	..	25/-
(23) Centring 100 sqt. for flume					
at -/8/- sqt.	..	..	..	..	50/-
(24) Bats & Siding per 100 cft.					
800 bricks at Rs. 19/1/- % cft.	..	..	..	..	15.40
Labour	..	..	..	..	3.75
Total					19.15
Say, Rs. 19/- % cft.					
(25) Sheet Piling per 100 sqt.					
@ Rs. 3/8/- sqt.	..	..	..	..	350/-
(26) Labour for fitting railings.					
Over bridges, etc. at 1/- cwt.	..	..	..	..	4/-
(27) Earth work % cft.					
From borrow-pits lead 50 ft 4'11/- % cft.	..	..	..	..	..
" " " " 100 ft. 5/- % cft.	..	..	..	..	..
" " " " extra lead -/10/- per chain.	..	..	..	..	..
Damp earthwork where considered necessary, 1/- % cft. extra.	..	..	..	..	..
Wet earthwork where considered necessary, 2/- % cft. extra.	..	..	..	..	..
Hardness allowances, up to 1/- % cft.	..	..	..	..	..
Hutting allowance where necessary, up to -/11/- % cft.	..	..	..	..	..
<i>Note.</i> —Officers should realize that allowances on earthwork rates are not to be added as a matter of course, but will have to be justified on local conditions.					
(28) Reinforced Brickwork for core walls per 100 cft.					
1,150 No. bricks @ Rs. 19/1/- % cft. (including 3 miles lead) ..	..	..	..	..	22.14
25 cft. cement mortar (1 : 4) @ Rs. 53/- % cft. ..	..	..	..	..	13.25
Labour including mixing	..	..	..	..	9.00
Placing reinforcement in position @ 2/8/- % cft. of Brickwork	..	..	..	..	2.50
0.30* cwt. reinforcement @ Rs. 10/- cwt. ..	..	..	..	..	3.00
Total					49.89
Say, Rs. 50/- % cft.					

* Includes 20% for over-lapping, etc. Reinforcement consists of 1 1/2" diameter rods spaced 20" apart laterally and 18" apart vertically.

APPENDIX B-III (c)

ANALYSES OF RATES FOR DRAINS AND SUKH BEAS WORKS.

(1) Lime Concrete per 100 cft.					
100 cft. as major works	..	..	..	..	40.00
Extra lead of 2 miles more at -/12/- mile	..	..	..	..	1.50
Total					41.50
or, Rs. 41/8/- % cft.					
(2) Pacca Masonry in Lime per 100 cft.					
100 cft. as major works	..	..	..	..	40.25
Extra lead of 2 miles at -/12/- mile	..	..	..	..	1.50
Total					41.75
or, Rs. 41/12/- % cft.					
(3) Dry Brick Pitching per 100 cft.					
100 cft. as major works	..	..	..	..	25.89
Extra lead of 2 miles at -/12/- mile	..	..	..	..	1.50
Total					27.39
Say, Rs. 27/- % cft.					
(4) Dry Brick Ballast per 100 cft.					
100 cft. as major works	..	..	..	..	18.90
Extra lead of 2 miles at -/12/- mile	..	..	..	..	1.50
Total					20.40
Say, Rs. 20/- % cft.					
(5) Metalling per 100 cft. (Brick-bats).					
100 cft. as major works	..	..	..	..	22.42
Extra lead of 2 miles at -/12/- mile	..	..	..	..	1.50
Total					23.92
Say, Rs. 24/- % cft.					

MAXIMUM FLOOD DISCHARGES.

	Pages.
Appendix C-I. Probable maximum flood discharge of the Chenab river at Trimmu headworks site and the waterway required for barrage at Trimmu	72
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APPENDIX C-I.

MAXIMUM FLOOD DISCHARGE OF THE CHENAB RIVER AND THE WATER-WAY REQUIRED FOR THE BARRAGE AT TRIMMU.

1. There has been some controversy in the past about the maximum flood discharge to be accepted for the Trimmu headworks site for project purposes.

2. Mr. F. M. Paves has discussed the subject in paras. 22 and 24 of the 1915 project report. According to 1893 flood levels, he worked out the discharge as 744,000 cusecs (with $N=0.025$) for the then weir site, which is about one mile below the Trimmu site now proposed.

3. Mr. A. R. Murray, as Superintending Engineer, Derajat circle in 1918, worked out the possible maximum discharge at Haveli as 307,500 cusecs, but recommended 500,000 cusecs for project purposes.

4. Mr. E. S. Lindley, Executive Engineer, Discharge division, in a note dated the 15th November 1923, obtained a discharge of 300,000 cusecs by extrapolating from data, observed at lower reaches, and considered 744,000 cusecs as utterly improbable.

5. In a note, dated the 30th December 1925, Mr. Quinton, Executive Engineer, Discharge division, stated that a 14 feet gauge at Haveli would give a discharge of about 300,000 cusecs. Extrapolating on this curve, Mr. B. N. Singh arrived at a figure of 600,000 cusecs for the maximum gauge of 16.8 feet, recorded on the 16th August 1921.

6. In 1928 (5th September), an actual discharge of 943,355 cusecs is said to have been observed at a gauge of 18.0 feet. According to original record of this observation, filed in the Discharge division, the observations were all made from one bank, the base line being 500 feet, the maximum inter-section angle, 88 degrees, and the contained width, 14,325 feet. The time of each observation ranges from 10 to 30 seconds. These figures are on the very face, thoroughly unreliable.

7. The absolute maximum flood in the living memory of man occurred on the 1st September 1929. The opportunity was availed of by Mr. A. N. Khosla, the then Officer on Special Duty, Haveli project. He calculated the maximum flood discharge by detailed investigations in the field, which took him and his staff about three months.

The flood marks, which were then more or less fresh, were double-levelled (the gauge at this site had been washed away by the flood). This gave a peak gauge of 17.5 feet at Haveli gauge site.

The maximum flood discharge at the Trimmu site calculated from the sections observed after the flood, was 625,000 cusecs.

8. The maximum flood discharge at Trimmu was determined by Mr. A. N. Khosla by another independent method also. The figures of peak discharges in 1929 for the Chenab and Jhelum rivers are given below:—

Site.	Distance from Mithankot in miles.	Peak discharge in cusecs.	Date and time of peak.
<i>Chenab River.</i>			
Marala ..	405	680,000	1 hour on 29th August 1929.
Khanki ..	369	*620,000	15 hours on 29th August 1929.
River bridge ..	232	325,000	18 hours on 31st August 1929.
Jhang ..	222	300,000	
<i>Jhelum River.</i>			
Mangla ..	412	760,000	3 hours on 29th August 1929.
Rasul ..	374	875,000	7 hours on 29th August 1929.
Chela ..	219	385,000	6 hours on 1st September 1929.

*(This figure is from discharge curve. Executive Engineer, Khanki, reported 800,000 cusecs which was held to be inaccurate).

Trimmu site is 11 miles downstream of Jhang and 9 miles downstream of Chela.

The average rate of falling off of the peak discharge between Rasul and Chela is $\frac{875,000-385,000}{155} = 3,100$ cusecs per mile, but according to the general trend of the curves the rate of falling off decreased in the downward travel of the flood. The rate of falling off between Trimmu and Chela was, therefore, taken as $3,100 \times \frac{3}{4} = 2,325$ cusecs per mile.

Similarly between Trimmu and Jhang, the rate of falling off was taken as $\frac{620,000-300,000}{150} \times \frac{3}{4} = 1,600$ cusecs.

∴ Contribution of the Jhelum river at Trimmu site
 = discharge at Chela minus $9 \times 2,325$
 = $3,85,000 - 20,925 = 3,64,075$ cusecs
 and contribution of the Chenab river = discharge at Jhang minus $11 \times 1,600 = 300,000 - 17,600 = 2,82,400$ cusecs.

Thus total discharge at Trimmu = $6,46,475$ cusecs
 say, $6,50,000$ cusecs.

9. On the Jhelum and the Chenab, the old established recording sites are at Jhelum and Wazirabad. Records of flood gauges go back to 1878, and show that maximum floods did, in fact, occur in 1929. Floods in both the rivers synchronised at Trimmu in 1929. $650,000$ cusecs, therefore, is an outside figure which may be expected to occur, perhaps once in 50 years or so.

Waterway required for Barrage at Trimmu.

10. Existing maximum flood level at Trimmu	=	492 R. L.
Afflux across the river	=	3 feet
Proposed maximum upstream flood level (excluding consideration of velocity of approach).	=	495 R. L.
Present minimum water level at Trimmu	=	471.7 R. L.
Probable level after retrogression	=	465.7 R. L.
Retrogression	=	6.0 feet
Maximum flood discharge	=	650,000 cusecs.

11. Crest level for undersluices is 476.0 R. L.

Head due to velocity of approach	=	2.0 feet
Depth on crest = $495 - 476$	=	19.0 feet

Discharge = $3.1 (19 + 2)^{1.5} = 3.1 \times 96.5 = 299$ cusecs per foot run, say : 00 cusecs.

Discharge which 16 undersluices of 30 feet span each can pass is = $:00 \times 480 = 144,000$ cusecs.

Balance to be passed by weir is = $650,000 - 144,000 = 506,000$ cusecs.

Crest of weir is at R. L. 489, i. e., 4 feet above undersluices.

Discharge for weir is $3.1 (15 + 2)^{1.5} = 3.1 \times 70.5 = 218$ cusecs per foot run.

Water-way required is $\frac{506,000}{218} = 2,330$ ft., i. e., $\frac{2,330}{60} =$ say, 40 spans of 60 feet each.

Actually the estimate allows for 54 spans. Sufficient protection has been allowed upstream and downstream for local concentration of discharge.

12. The waterway allowed per foot run for barrage and undersluice bays in the Sutlej Valley project and Trimmu are :—

		Discharge in cusecs per foot run for barrage.	Discharge in cusecs per foot run for undersluices.
Sutlej Valley weirs.	Ferozepore	258	..
	Suleimanki	145	240
	Islam	208	342
	Panjnad	248	..
	Trimmu as proposed	218	560

The above shows that 40 bays of barrage and 16 bays of undersluices are ample.

APPENDIX C-II.

MAXIMUM FLOOD DISCHARGE OF THE RAVI RIVER AND THE WATER-WAY
REQUIRED FOR THE BARRAGE AT ABDUL HAKIM.

1. The following are the actual maximum discharges as recorded in the past at Sidhnai:—

		<i>Cusecs.</i>
On 11th August 1890	..	67,272
On 26th June 1894	..	66,357
On 30th August 1917	..	58,528
On 21st August 1925	..	65,208

Highest flood level at Sidhnai and at Abdul Hakim occurred on 5th August 1914. Heavy silt movement, however, is reported from Sidhnai, about this time, and the discharge does not seem to have been abnormal (see Irrigation Branch Administration Report for the year 1914-15). The actual discharge on 5th August 1914, as recorded at Sidhnai, was only 35,300 cusecs.

2. In view of the excessive floods, which have been experienced in other rivers, an adequate margin should be provided above the floods experienced in the past. It is proposed that a margin of 20 per cent. on the maximum of 67,272 cusecs should suffice. This would give a discharge of 82,726 cusecs.

3. It may be useful to compare the above figure, with the maximum discharges experienced at various other sites on the Ravi:—

		<i>Cusecs.</i>
Madhopur approximately	..	2,00,000
Shahadara approximately	..	93,000
Balloki approximately	..	97,000

4. The North Western railway have recently considered Ravi discharges in connection with their new bridges at Dera Baba Nanak and Tandlianwala. As a result, the North Western railway provided for 115,000 cusecs at Dera Baba Nanak and 88,000 cusecs at Tandlianwala.

The distance along the river, including small curves between the various sites, are as follows:—

		<i>Miles.</i>
Madhopur to Dera Baba Nanak	..	40
Dera Baba Nanak to Shahadara	..	44
Shahadara to Balloki	..	26
Balloki to Tandlianwala	..	32
Tandlianwala to Sidhnai	..	80

Assuming the peak discharge to alter with the distance, on account of the damping effect on the way, the figure for Balloki, corresponding to those provided by the North Western railway, would be 113,000 cusecs.

5. From the above, it appears that 82,000 cusecs should be an outside figure for maximum flood discharge, on which to base the design of the barrage across the Ravi at Abdul Hakim.

The design consists of 11 bays of 30 feet for the weir and 4 bays of 30 feet for the undersluices, with R. L. 471 as the maximum afflux level and with the crests at R. L. 458 and 453 for weir and undersluices, respectively. The barrage will be capable of passing the following discharge:—

	<i>Cusecs.</i>
Weir = $11 \times 30 \times 3.1^{1.5} =$	.. 53,605
Undersluices = $4 \times 30 \times 2.8 \times 19^{1.5} =$	.. 27,821
Total	.. 81,426

The above calculations assume a velocity head equal to 1 foot.

The barrage across the river will probably raise the maximum flood water levels by $1\frac{1}{2}$ feet.

FORECAST OF PROBABLE IRRIGATION.

Pages.

APPENDIX D-I.

Probable area of irrigation on the Haveli canals	
(i) Note, dated the 20th June, 1935, on the probable area of irrigation, based on the mean Chenab supplies for the last 12 years, available for utilization on the Haveli canals with a discussion on the minimum supply required during December, January and February to mature the areas sown, by Mr. Kanwar Sain, I.S.E., Executive Engineer on Special Duty	76
(ii) Note, dated the 26th June, 1935, by Mr. J. D. H. Bedford, Chief Engineer (Construction Administration) Irrigation Works, Punjab	85
(iii) Note, dated the 1st July, 1935, by Mr. F. J. Waller, C.I.E. Chief Engineer (Northern Administration) Irrigation Works, Punjab	87
(iv) Note, dated the 2nd July 1935, by Mr. J. D. H. Bedford, Chief Engineer (Construction Administration) Irrigation Works, Punjab	91
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APPENDIX D-I.

PROBABLE AREA OF IRRIGATION ON THE HAVELI CANALS.

Note, dated the 20th June 1935, on the probable area of irrigation, based on the mean-Chenab Supplies for the last 12 years, available for utilization on the Haveli canals, by Mr. Kanwar Sain, I.S.E., Executive Engineer on Special Duty, Haveli Project, with a discussion on the minimum supply required during December, January and February to mature the areas sown.

1. The supplies available for utilization at Trimmu headworks, based on the Discharge division figures and in accordance with the proposed agreement with the Bahawalpur State, are shown in Appendix A-I. An abstract of these average supplies, as accepted, showing the share of perennial and non-perennial areas in each month, is given in statement III of Appendix A-I.

2. In this note, an attempt has been made to determine the probable areas of irrigation, in summer and winter that will be sown and matured with the supplies available. The perennial and non-perennial areas will be considered separately.

PERENNIAL AREA.

3. An examination of duties on various canals shows that the rate of water consumption for the same area of crops varies considerably on different canals. Before the probable areas of irrigation can be forecast with fair accuracy, it is necessary to analyse the various factors which influence the duty. The most important of these factors are :—

- (a) Availability of supply, at the correct sowing time, for valuable summer and winter crops.
 - (b) Weather and climate including rainfall.
 - (c) Inefficiency of channels and inequitable distribution of supplies.
 - (d) Discharge available per thousand acres of culturable commanded area.
 - (e) Personal factor of cultivators.
 - (f) Soil quality.
 - (g) Different rates of water consumption by different crops.
- Each of these will be discussed in turn.

(a) *Availability of supply, at the correct sowing time, for valuable summer and winter crops.*

4. Without going into the details of cost of production of various crops and the resulting net profits therefrom, it may be stated that cotton, sugarcane, indigo and rice are the most paying summer crops, while out of the winter crops wheat occupies the same position. Toria costs less to produce and yields fairly good profits.

On the whole, the above summer crops are more paying than the winter crops. A reference to the proceedings of the Crop-planning Conference, held at Simla on the 8th and 9th June, 1934, shows that the future prospects of cotton and oil-seeds are better than wheat, although, with reference to the last mentioned crop, the Conference came to the conclusion that the figure of wheat acreage at present could not be said to have exceeded the margin of safety. This position of wheat is likely to be unfavourably affected by the increase, within the next few years, of the wheat area under the Sukkur Barrage.

5. The cultivator, after satisfying his minimum needs for fodder crops and sundry miscellaneous crops, must try to put in as much area under cotton, as he can, on the supplies available in the sowing period, provided he can hope to get sufficient supplies for maturing it. The area under rice and sugarcane is necessarily limited on account of the heavy water consumption of these two crops. Indigo yielded very good profits before the synthetic colour of the same name came in the market after the War. Even now the cultivators in the Multan district do not undervalue indigo as a profitable crop, because it is considered to yield excellent manure to wheat, sown in rotation with indigo.

6. With the exception of rice, all the other valuable summer crops are best sown up to the middle of June, and may, therefore, be accepted that the supplies available from the 1st of April to the 15th of June have the maximum revenue earning value. If the supplies in this period are short, a cultivator may utilise the more abundant supplies in the monsoon months for putting in less valuable summer crops, provided he still leaves a fair area for wheat.

7. Wheat sowings are done from the 16th of October to the 10th of December, the best sowing month being November. Supplies before the 16th of October would be mostly required to mature cotton, although the surplus water would obviously be taken to put in gram and toria. This would make up for any water used in the second half of October for maturing late sown cotton. After the 10th of December only tobacco, vegetables and some fodders can be sown.

A mathematical investigation into the relationship of the area sown in winter and the available discharge from the 16th October to the 10th December, both on the Sidhnai and the Lower Bari Doab canals, was made. The correlation factor found between these two variables was as high as 0.91. Therefore, the critical period of supply for the winter season may be considered to be from the 16th of October to the 10th of December. In paras. 21 and 25, the forecast is based on the water available in this period.

8. It may be argued that the cultivators will come to know from experience, what supplies to expect in the canal, during the maturing period, and they will limit their areas of crops accordingly; but in practice, it has been seen that for maturing the areas, the cultivator gambles either on rainfall or the chance of getting better supplies in the canal in that particular year. It must not be forgotten that the Punjab is a land of small cultivators. There is very little large scale farming. The rule is that a peasant cultivates a few acres with a pair of bullocks and the assistance of his family. The laws and customs of the country, governing inheritance, favour the partition of the immovable property amongst a number of heirs, with the result that the holdings get smaller and smaller. His bullocks to till the land and his family to assist in tilling and sowing are there. In the land, left over from valuable summer crops, he sows as much wheat area as he can with the supply available in the wheat sowing period. For maturing this area, he gambles. If it rains or the river is more kindly, well and good, otherwise he expects to get the best advantage out of the *Kharaba* rules.

9. If the supplies after the 10th of December are more copious than required to mature the areas sown, much of this water goes unnecessarily to raise the delta or at best to improve the outturn, but does not affect the area sown. Lesser supplies than the maturing requirements result in more *Kharaba*.

(b) *Weather and climate including rainfall.*

10. Rainfall is, of course, the most important factor under this head, and is, to a great extent, responsible for the heavy variation of duties on the various canals and in various reaches on the same canal. The mean rainfall from the 1st April to the 30th September in the Punjab districts, leaving out the mountainous and sub-mountainous tracts, varies from 5.29 and 4.58 inches in the districts of Multan and Muzaffargarh to as much as 19.39 and 21.52 inches in the districts of Amritsar and Ludhiana. Also the variations, from year to year, in the same districts are generally heavy. During these months, therefore, rain has an important bearing on the demand in the canal. There are some areas, where the rainfall is generally good, and the crops do not depend wholly on the canal supply at any time, such as in the Delhi and Karnal divisions of the Western Jumna canal, and on certain parts of the Sirhind canal. But even here, there occur periods when, were it not for the canal supply, the crops would either fail or be seriously damaged. During these dry periods, the canal is supplying water up to its full capacity, and it is at such times that the canal acts as a limiting factor in agricultural operations. This applies to the summer.

One way to eliminate this variable influence of summer rainfall is to work on "Duty on Capacity" (this is defined as "the full supply factor attained by a project system or channel after it has been opened for irrigation," page 6, item 57 of Glossary of Technical Terms, Central Board of Irrigation, Publication No. 5), rather than on the duty, based on the mean supply during the currency of the crop.

11. The case is different in the winter. During the summer, ample water is usually available to meet the canal demand and the canal supply is dependent on the demand and is limited only by the carrying capacity of the channels. In winter, however, the available supply in the river, as a rule, is always less than the channels can carry.

12. The variation of rainfall during the months of October, November and December is from 0.37 and 0.34 inches in the districts of Multan and Muzaffargarh to 1.09 and 0.99 inches in the districts of Ludhiana and Amritsar.

This rainfall is too small to reduce the demand below the available supply, but has an important bearing, not only on the question of ~~the~~ but on the areas to be irrigated per cusec-day. A greater rainfall encourages the sowing of greater area of irrigated crop, as the chances of maturing with canal water are there. This, however, does not apply to parts of the Western Jumna and Sirhind canals, where the combination of a late monsoon and a good winter rain results in large areas of rain-sown crops, thus reducing the canal supply to a secondary importance.

APP. D-I.

13. The delta rises, as the rainfall decreases, both in summer and winter. This is clearly shown by the following figures of the four divisions of the Lower Bari Doab canal :—

APP. D-I.

Name of division.	AVERAGE DELTA FOR 11 YEARS 1920-21 TO 1930-31.		RAINFALL MEAN OF 22 YEARS.			
	Summer.	Winter.	Part of the district covered by Lower Bari Doab canal.	1st April to 30th September.	Early winter October to December.	Late winter January to March.
Balloki ..	Ft. 2.8	Ft. 1.6	Lahore ..	Inches. 12.25	Inches. 1.32	Inches. 1.56
Okara ..	3.0	1.8	Montgomery ..	9.44	1.50	0.87
Montgomery ..	3.3	2.0				
Khanewal ..	3.6	2.2	Multan ..	6.78	1.07	0.53

14. As the rainfall in the Multan and Muzaffargarh districts covered by the Haveli project is less than any other district enjoying perennial irrigation in the Punjab, the area that may be expected to be irrigated by a cusec-day on the Haveli canals would be somewhat less than on other canals.

15. Regarding weather and climate, enough data is not available on the subject of temperature and humidity, but in general it may be said that these factors will reduce the efficiency of canal water in the districts covered by the Haveli project as compared with the other perennial canals.

(c) *Inefficiency of channels and inequitable distribution of supplies.*

16. These two factors are likely to reduce the duty in the early years of the opening of a canal, and would probably be rectified in due course. The general gradual improvement in duty noticeable on all canals is to a great extent due to this factor.

The more equitable the distribution of supply is, the more areas may be expected to be irrigated from the same supply. In view of this, it is proposed to assume a lower efficiency for irrigating capacity of water in the earlier years of development.

(d) *Discharge available per 1,000 acres of culturable commanded area.*

17. From a study of the area irrigated per cusec-day and the discharge supplied per 1,000 acres of culturable commanded area in the case of the Lower Bari Doab and the Sidhni canals as well as the Jhang and Khanewal divisions, it appears that the efficiency goes down as the supply per 1,000 acres of culturable commanded area goes up. The deduction is that when the supplies are less than normal, the cultivators are more careful in applying the available supply to their fields, while in case of abundant supplies, they give heavier waterings. The results are shown on the attached graph sheet. This ignores the question of yields per acre.

This factor would tend to reduce the duty in good years of supply and raise it in dry years.

(e) *Personal factor of cultivators.*

18. On the existing Sidhni canal, both the summer and winter duties are a little lower than those of the Jhang division and are definitely better than those obtained in the Khanewal division. This would indicate that the cultivators in this area are fairly efficient irrigators. As the fields are prepared for well waterings, a greater efficiency in the use of canal water on these fields must result.

As canal water is increased and greater areas are sown, the preparation of fields into small kiaris will be less perfect. It is, therefore, probable that the efficiency in the use of canal water will be lowered.

(f) *Soil quality.*

19. Sufficient data is not available for making a comparison of the soils regarding their qualities, in respect of water consumption. The variation in duty on the various canals may be partly due to this factor.

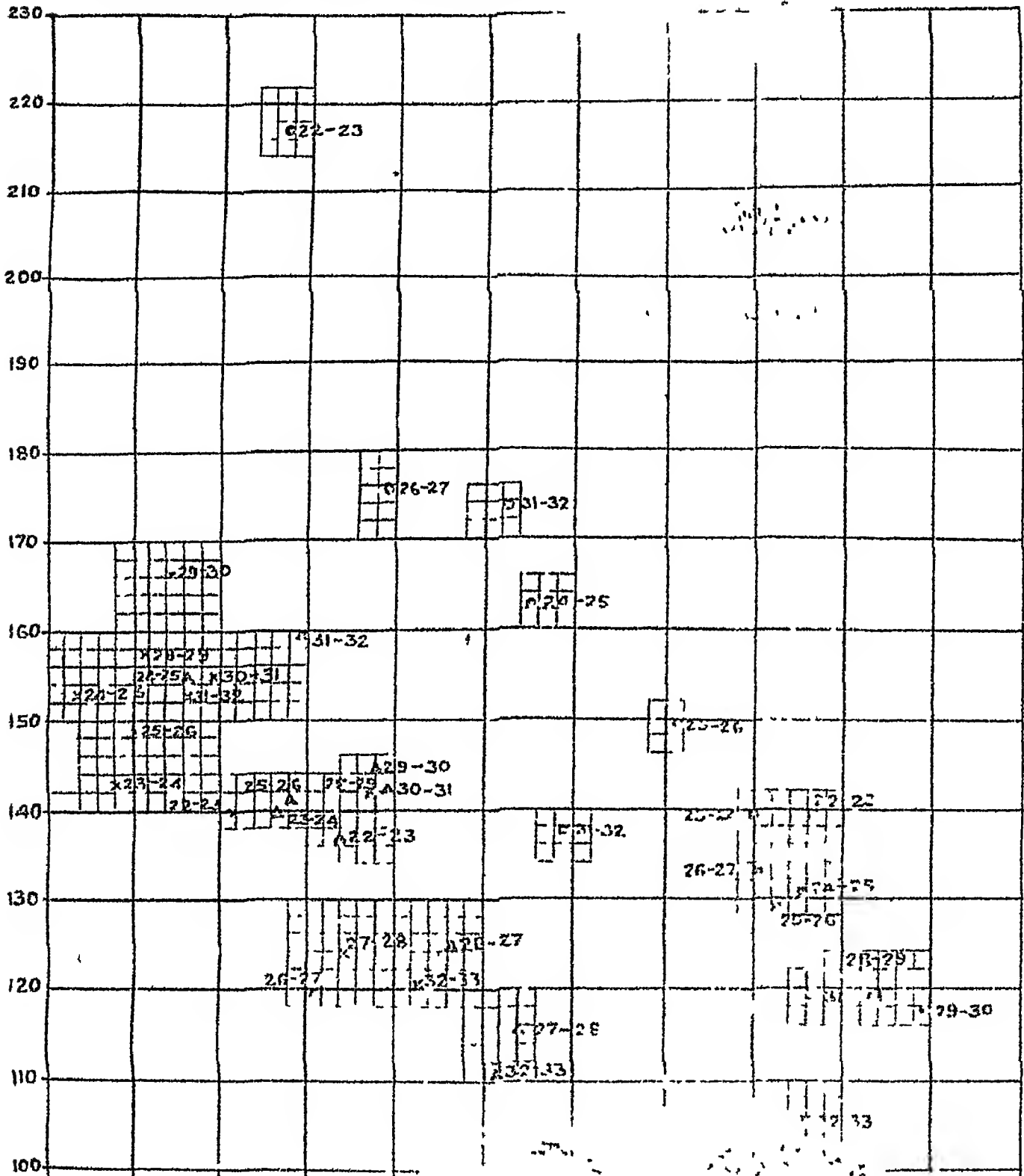
The soil in the perennial area of the Haveli project does not appear to be inferior to any other, so far as can be judged from the irrigation results of the existing Sidhni canals.

— REFERENCES —

SYSTEM C
 H.C. A
 LG DIVISION H
 FINANCIAL DE X

— EFFECT OF SUPPLY —

— PER % ACRES ON EFFICIENCY —



(g) *Different rates of water consumption by different crops.*

20. During summer, the predominant crop is cotton and during winter it is wheat. The requirements of these two crops may be said to mask the requirements of all others. During the monsoons, sufficient supply is available in the canal for the greater requirements of the monsoon crops. The case of sugarcane, however, requires special consideration. This crop takes water from March right up to November, and thus competes both with the summer as well as the winter crops in their sowing periods. A greater area of sugarcane will, therefore, reduce the annual cropped area for a unit discharge.

Summer and winter duties.—

21. Having discussed the factors which influence the duty, it is now easy to assign a reasonable value to duty that may be expected on the opening of the Haveli project, in the light of figures attained on the other canals.

It is considered that the best results would be achieved from a study of the figures of the two neighbouring divisions, the Jhang division of the Lower Chenab canal and the Khanewal division of the Lower Bari Doab canal and of the existing Sidhnai canal itself. Irrigation data for these have been abstracted from the statistics and the results in tabular form are enclosed as statements I, II and III. It will be noticed that there is a gradual rise in duty up to 1929-30, after which year, there is a slight drop on account of depression in the rates of agricultural produce.

22. Taking into consideration all the factors involved, it would be quite safe to accept the following figures, on the analogy of the Khanewal division:—

See cols. 6 and 6(a) of statements I, II and III.	(i)	Summer duty on capacity of distributaries for the first five years	=	70
	(ii)	Summer duty on capacity of distributaries after the first five years	=	80
See col. 14 of Statements I, II and III.	(iii)	Winter area, expected to be sown per cusec-day of the supply from the 16th October to the 10th December, in the first five years	=	2.5
	(iv)	Winter area, expected to be sown per cusec-day of the supply from the 16th October to the 10th of December, after the first five years	=	2.8

23. Actual duties in summer at outlet heads, obtained during crop experiments of 1929-30 and 1930-31, ranged from 94.0 acres in the case of Jhang division to 131 acres in the Sargodha division. These are equivalent to 85.5 and 118 acres at the distributary heads.

An abstract, showing the principal irrigation data of the perennial distributaries of the Punjab canals, is given in statement IV. On the same sheet are shown the anticipated figures for the Haveli project.

Probable area of irrigation in summer:—

24. The capacity of perennial distributaries is 2,750 cusecs less 1/6th for losses in main canal and branches = 2,292 cusecs say 2,300 cusecs.

The probable area of irrigation in the first five years will be $2,300 \times 70 = 161,000$ acres.

The probable area of summer irrigation after the first five years will be $= 2,300 \times 80 = 184,000$ acres.

Probable area of winter irrigation based on average supply:—

25. The average supply available for the perennial area from the 16th October to the 10th December has been worked out from Appendix A-I. Statement III.

Available at Trimmu Head.	Cusecs \times days	=	Cusec-days.
16th to 31st October	1,935 \times 16	=	30,960
November	2,475 \times 30	=	74,250
1st to 10th December	2,142 \times 10	=	21,420
	Total	=	126,630
Deduct for losses in main canal and branches (one sixth) =			
		=	21,105
Available at distributary heads			
		=	105,525
The probable area of irrigation in the first five years will be =			
		=	203,813
The probable area of irrigation after the first five years will be =			
		=	250,470

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Water required for maturing the area sown in winter :—

26. This will depend on climatic conditions and mostly on the rainfall during this period. The variation of mean rainfall in some of the Punjab districts, during this period, is shown by the following figures :—

Name of District.	Mean Rainfall from 1st January to 31st March.	
		Inches.
Karnal	..	3.01
Rohitak	..	1.74
Hissar	..	1.69
Ludhiana	..	3.6
Ferozepore	..	2.49
Lahore	..	2.70
Amritsar	..	3.72
Sargodha	..	2.47
Montgomery	..	1.48
Lyallpur	..	1.80
Jhang	..	1.70
Multan	..	1.13
Muzaffargarh	..	1.03

The importance of rainfall during this period will be realised from the fact, that one inch of uniform rainfall over the winter-cropped area, covered by the perennial channels of the Haveli project, is equivalent to $295,470 \times 1/12 \times 1/90 = 123$ cusecs, flowing continuously from the 1st January to the 31st March. This variation of rainfall must, therefore, be kept in mind, when comparing the requirements of various canals in the maturing period.

27. The winter season may be divided into three convenient periods for purposes of water supply to the crop :—

Sowing period	16th October to 10th December	=	Days. 56
Intermediate watering period	.. 11th December to 10th February	=	62
Maturing period	11th February to 31st March	=	49

Figures of water supply during these periods have been collected for the Sidhnai canal, and the Jhang and the Khanewal divisions, and compared with the percentage of *khara* in statement V attached to this note.

On the Sidhnai canal, least *khara* in winter was given during the year 1922-23. The crop matured was 93.46% of that irrigated. The supplies in the intermediate watering and maturing periods were 66.5 and 85.4 % of the sowing period supply. This supply was supplemented by 5,183 irrigation wells in use in that year.

In the Jhang division, the year 1925-26 had only 1.7% *khara*, while the supplies, in the intermediate watering and maturing periods, were 81.4 and 99.6% of the sowing period supply.

In the Khanewal division, the winter crop 1924-25 may be considered as the best representative crop. The *khara* was 7.4% and the supplies, in the intermediate watering and maturing periods, 70.6 and 90.1 per cent. of the sowing period supply. During the year 1931-32, there was less *khara* and the supplies in the intermediate watering and maturing periods were only 64.8 and 81.6 per cent. This year, however, cannot be taken as a guide, as the rainfall during this year in the Montgomery district was 14.14 inches against 9.99 inches in the year 1921-25.

From a study of the figures discussed in this paragraph, it would be obvious that the combined supply from canal and wells, in the intermediate watering and maturing periods, must not be less than 70 and 90 per cent. of the sowing period supply, while it would be advantageous to increase this to 80 and 100 per cent. respectively.

28. From the above, the minimum requirements for the perennial area of the Haveli project can be worked out.

The average supply at Trimmu head, available in the sowing period, 16th October to 10th December = 126,630 cusec-days.

Minimum required supply in intermediate watering period = 70 per cent. of 126,630 = 88,641 cusec-days.

Minimum required supply in the maturing period = 90 per cent. of 126,630 = 113,967 cusec-days.

29. The supply that would be available from the canal on the basis of 825 cusecs limit during December, January and February, is worked out below :—

Intermediate watering period— *Cusec-days.*

11th December to 31st December (31×825)—(2142×10)	=	4,155
1st January to 10th February (825×41)	=	33,825
Total	..	37,980

Maturing period —

11th February to 28th February (825×18)	=	14,850
March (2699×31)	=	83,669
Total	..	98,519

30. If the limit of maximum mean withdrawals during December, January and February, be raised to 1000 cusecs, then the available supply would be :—

Intermediate watering period— *Cusec-days.*

11th December to 31st December (31×1000)—(2142×10)	=	9,580
1st January to 10th February 1000×41	=	41,000
Total	..	50,580

Maturing period—

11th February to 28th February (1000×18)	=	18,000
March (2699×31)	=	83,669
Total	..	101,669

31. Supply required in addition to the canal water can be drawn from the wells, as is being done at present in the Sidhnai area.

The existing number of irrigation wells in the proposed perennial area is :—

Existing Sidhnai canal area	..	4,974	} From statistics of the canals in the Punjab for 1932-33.
Existing Koranga canal area	..	405	
Existing Fazilshah canal area	..	654	
Existing Abdul Hakim canal area	..	317	

Existing in the additional area, being converted into perennial :—

North of Ravi	..	130	} From 4 inch to 1 mile survey sheets.
South of Ravi	..	1,020	
Total		7,500	

The discharge of a well depends on the efficiency of the bullocks and the lifting gear, as well as the depth of water below the natural surface. In the Haveli project area the average discharge of one well may be taken as one-tenth of a cusec. Thus a discharge of 750 cusecs could be obtained from the wells existing at present, in this area.

It is likely that the wells will have to be worked throughout the intermediate watering period, while in the maturing period wells need not work after the 28th February.

The total maximum supply that can be obtained from the existing wells in the intermediate watering period will be $750 \times 62 = 46,500$ cusec-days.

This supply is available at water-course heads. To get its equivalent at Trimmu headworks for purposes of comparison, 10% loss in distributaries and 20% loss in branch and main canals should be added.

	<i>Cusec-days.</i>
Available from wells	.. 46,500
Add for 10% loss in distributaries	.. 4,650
Equivalent supply at distributary heads	.. 51,150
Add for 20% loss in main canal and branches	.. 10,230
Equivalent supply at Trimmu	.. 61,380
Deduct 33 1/3% for non-continuity in the working of wells on account of sickness of men and cattle, and time lost in shifts.	20,460
Total	40,920

* Actual figure, since recommended by the Delhi Water Committee in their Report, Volume I, page 20, table II, column 3, is 990 cusecs.

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On the same basis, maximum supply available from the existing wells, from 11th February to 20th February, will be $40920 \times 18/62 = 11,880$ cusec-days.

32. The figures of paragraphs 28, 29, 30 and 31 are summed up below :—

	Intermediate watering period.	Maturing period.
	cusec-days.	cusec-days.
(a) Minimum supply required	*88,641	113,967
(b) Supply available from the canal, on the basis of 825 cusecs mean maximum supply in December, January and February	37,980	98,519
(c) Supply available from the canal, on the basis of 1000 cusecs mean maximum withdrawals in December, January and February	*50,580	101,669
(d) Additional supply required from wells in case (b)	50,661	15,448
(e) Additional supply required from wells in case (c)	*28,061	12,258
(f) Maximum supply available from the existing number of wells (7500 No.) on the assumption that wells are equally distributed and are capable of equal and maximum output.	40,920	11,880

This shows the necessity of insisting on 1,000 cusecs as a minimum for the mean maximum withdrawals during December, January and February.

In the case of 825 cusecs limit, the additional number of wells required comes to about 1,800 to make up the minimum supply in the intermediate watering periods while, in the maturing period, wells shall have to be worked in part of March as well. These additional wells will be mostly required in the new Crown lands.

33. Assuming that it will be possible to get 1,000 cusecs mean supply during December, January and February, the case of Crown lands may be specially considered.

The number of irrigation wells in the good Crown waste area, for which water has been allowed in the project, is only 50 in an area of 79,472 acres; the remaining 7,450 wells being in the proprietary area of 539,455 acres.

The sinking of new wells must necessarily hold up the development of Crown waste areas. It is suggested that channels, irrigating Crown waste areas, should be given slightly preferential treatment during December, January and February. This would be facilitated, if the Crown lands could be put on entirely separate distributaries. This point should be kept in mind, when actually constructing the distributaries, after sanction to carry out the project, has been received.

NON-PERENNIAL AREA.

Duty.

34. The main difference between the perennial and non-perennial areas is that the first winter waterings in the latter areas are done earlier than on the perennial areas, and winter crops compete with standing summer crops for water to a greater

*For intermediate period only :—

(a). Minimum supply required	88,641
(c). Canal supply	50,580
(c). Well supply	38,061

Percentage of area matured on well supply is $\frac{38061}{88641} = 43\%$

Area sown 295,000 acres. Area matured by wells. $\frac{295000 \times 43}{100} = 125,000$ acres

Number of wells 7,500
Area matured per well $\frac{125,000}{7,500} = 16.7$ acres

If the canal supply is kept down to 825 cusecs, the area per well becomes 22.6 acres. As this is based on all the wells in the district it is unduly high, even compared with the figures in the Assessment Report of Multan and Shujabad Tehsils of Multan district, page 13.

J. D. H. BRIDGEMAN.—26-6-1935
Chief Engineer, Construction.

extent. The non-perennial canals in the Haveli project have a distinct advantage over other non-perennial canals in the Province, as there is generally sufficient water available to keep them open till the 31st of October. With this difference, the duty on the non-perennial canals will be dependent on all the factors, discussed in detail under the perennial canals.

35. As the summer crops are more paying, the cultivator on the non-perennial canals also may be expected to put in as much area under valuable summer crops as he can. Also he will try to grow most of his fodder in the summer, when abundant supply is available. On account of the following two reasons, however, the summer 'duty on capacity' on non-perennial canals of Haveli project cannot be taken the same as for perennial canals:—

(a) The cultivators on the present inundation canals, proposed to be converted into non-perennial, have been used to unnecessarily heavy waterings, for a long time past.

(b) Winter waterings will begin earlier, and thus reduce the water for maturing of summer crops to a certain extent.

36. The duty on capacity for the summer distributaries of Sabraon branch of Jandiala division, Upper Bari Doab canal, for 1932-33, was $\frac{39,893}{415} = 96$, while for the perennial distributaries on the same canal and the same year, it was $\frac{49,829}{475} = 105$ acres. This gives a ratio of about 91 to 100 in the duties on the two systems. Allowing, for the reason given in paragraph 35 (a), a ratio of 4 to 5 may appear to be reasonable.

For the perennial canals in the Haveli project, a duty on capacity of distributaries equal to 70 acres, for the first five years and 80 acres for subsequent years has been assumed. On the non-perennial canals, it would be safe to work on a duty of 55 acres for the first five years and 65 for subsequent years.

37. A comparison with the duties, attained on the Chenab Inundation canals or the non-perennial distributaries of the Sutlej Valley project, would serve no useful purpose, as the conditions of supply on the Haveli canals are far better than on either of them. A study of the figures of the Sidhnai canals in certain years, when there was good supply from the 15th April to the 10th June and from the 1st September to the 31st October, and comparatively less supply from the 1st November to the 10th December, may be interesting, from the point of view of comparison. For this purpose, two years 1928-29 and 1930-31 are selected, and the water-supply actually received by these canals is compared with the average supply, which this area would receive at the same rate as is being given to the non-perennial areas in the Haveli project.

Month.	SUPPLY RECEIVED BY THE SIDHNAI AND SUBSIDIARY CANALS IN CUSEC-DAYS.		Supply that would be given to equivalent non- perennial area (305,629 acres culturable com- manded area) in Haveli project at branch head in cusec-days.
	1928-29.	1930-31.	
Branch capacity	2,650 cusecs	..	2,580 cusecs
April	17,085	16,748	38,700
May	39,273	49,714	79,980
1-10th June	17,147	16,750	25,800
(A) Total 1st April to 10th June ..	73,505	83,212	144,480
September	47,313	59,556	77,400
October, 1-15th	13,990	16,741	33,900
October, 16th-31st	6,614	8,929	25,920
(B) Total 1st September to 31st October ..	67,923	85,226	137,220
1st November to 10th December ..	6,938	8,373	Nil.
(C) Total 1st September to 10th December ..	74,921	93,599	137,220

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38. The above figures show that the conditions of water-supply in the Haveli non-perennial area would be much better in the two critical periods than even the existing Sidl-nai canals. A better 'duty on capacity' may, therefore, be expected, while the probable ratio of summer to winter crops will be the same. The following information for the two selected years has been worked out from the figures given in the Statistics of the Working of Distributaries of the Sidl-nai system:—

	1928—29.	1930—31.
Summer duty	96	99
Summer duty on flood capacity of distributaries ..	57.2	53.3
Percentage of summer irrigated area to culturable commanded area	37.6	35.0
Percentage of winter irrigated area to culturable commanded area	36.4	34.2

Thus a final 'duty on capacity' equal to 65 acres for non-perennial areas of Haveli appears to be on the safe side. On the same analogy, the probable ratio of summer to winter crops will be 1 to 1.

Probable area of irrigation.

39. The capacity of the non-perennial distributaries is $5,000 \times \frac{5}{6} = 4,167$ acres.

The probable area of summer irrigation in the first five years will be $4,167 \times 55 = 229,190$ acres.

The probable area of summer irrigation after the first five years will be $4,167 \times 65 = 270,860$ acres.

The same areas will, probably, be irrigated during winter.

Comparison with the existing Chenab Inundation canals and the Muzaffargarh Inundation canals.

40. Statement VI compares the results, anticipated from the Haveli non-perennial canals, with the existing inundation canals in the same area.

On the Wali Mohammad and Taliri canals, the best summer intensity on culturable commanded area, attained during the last 10 years, was 39.4 and 30.6, respectively, in the year 1928-29. The anticipated summer intensity on the Haveli non-perennial canals is 38.4% with better supplies in April, May, September and October. With these better supplies in the critical periods, the duties on the non-perennial Haveli canals will, evidently, be better than those on the present inundation canals. The figure of summer duty on capacity, as adopted in this note, for the proposed non-perennial canal is, therefore, on the safe side. Better supply in October would enable more areas being sown in the winter.

KANWAR SAIN—25-6-33.

*Executive Engineer on Special Duty,
Haveli project.*

**Note, dated the 26th June 1935, by Mr. J. D. H. Bedford, Chief Engineer,
Construction Administration, Irrigation Works, Punjab.**

A very full note of Mr. Kanwar Sain, Executive Engineer on Special Duty, Haveli project, deals with the probable irrigation, to be obtained from the allotted supplies of water for the perennial and non-perennial canals of the Haveli project. He has given data and statistics, fully justifying the proposals he has made:

The present average perennial irrigation is 313,000 acres and will be increased to 479,000 acres giving a net increase of 166,000 acres. In the non-perennial areas, the present mean yearly irrigation is 241,000 acres, which will be increased to 542,000 acres, giving a net increase of 301,000 acres.

2. The percentage of proposed perennial irrigation to gross area is 69 per cent. The percentage of the non-perennial summer irrigation to gross is 33 per cent., and we hope to get the same percentage of winter first waterings in our non-perennial area. This forecast has been prepared by the Executive Engineer on Special Duty, on the following considerations:—

He has taken for a guide irrigation conditions in the Khanewal division, the Jhang division and the present Sidhnai. Khanewal and Jhang divisions most nearly correspond to conditions in the Haveli, though the rainfall in these divisions is, probably, somewhat more than in the Haveli. He has shown what the duties are over a period of years in these two divisions in the summer, and has, then, selected a "duty on capacity," which is somewhat less than in these two divisions.

3. For the winter crops he has shown that a forecast cannot be made with accuracy on capacity discharge, because the available supply is always less than capacity. He has also shown that the period, 16th October to the 10th of December, best corresponds to the winter sowing period. He has worked out the number of acres, which water in the Khanewal and Jhang divisions irrigates per cusec-day, and has proposed, for the purposes of the forecast, a figure somewhat less than the average of Jhang and Khanewal divisions and also less than what is obtained in the Sidhnai area at present.

The full supply factor of 80 for the summer and 2·8 acres per cusec-day for the winter crops for the sowing period are thus clearly safe figures from which to calculate the probable irrigation.

Having obtained the figures of rabi sowing by the above method, he has examined the position as regards water supplies in the intermediate watering and maturing periods. Here again, we have actual figures over a long period of years for the Khanewal and the Jhang divisions.

Reference is invited to statement V.* We see that in the Jhang division we want 81 per cent. of the sowing period water for intermediate watering and 99·6 per cent. for maturing, i.e., to say that the total amount of water required to mature a crop is nearly twice as much as is required to sow it. In the Khanewal division it is about 1½ times the amount of water required to sow it. On the other hand, in the Khanewal division, more water is used per unit of crop sown than in the Jhang division, so that there is little to choose between either divisions as to the amount of water required, which may be taken twice as much for maturing as for sowing.

The above gives conditions of moderate crop remissions.

On the Haveli perennial, the supply assumed for intermediate watering and maturing is 1·6 times of the supply required for sowing. This can readily be seen to be the minimum. Assuming that the full, 7,500 wells are working for 16 hours in every 24 from the 11th December to the 1st of March, and limiting ourselves to 1,000 cusecs of continuous supply during this period, we find that we just get 1·6 times the supply to mature the crop as compared with the water available to sow it.

4. It is clear from the above, that in addition to working all the wells,† we must have a minimum mean supply of 1,000 cusecs in the months of December to February, if we are not going to lose large areas of crops. Crop remissions represent wastage of human effort, and as such are undesirable. A comparison between the ratio of mean supplies to capacity between canals is extremely misleading, because in such comparison, no account is taken of the difference in rainfall in the winter period. Para. 26‡ of the Executive Engineer on Special Duty's note shows that differences in rainfall are large and vitiate such comparisons. For example, the rainfall in Multan and Muzaffargarh in the winter is 2½ inches less than in Amritsar. This 2½ inches is equivalent to 308 cusecs flowing continuously for 3 months in the Haveli. 308 cusecs is nearly 37 per cent. of 825§ cusecs, which is the proposed limit for the Haveli from December to February, so that if the Upper Bari Doab was obtaining the same percentage of capacity, as the Haveli, it would, in reality, be obtaining 37 per cent. more as represented by rain.

* Page 96.

† Each well has to deal with 10·7 acres of irrigation.—See para. 32 of Executive Engineer on Special Duty's note, dated the 20th June, 1935.

‡ Page 80.

§ Actual figure, since recommended by the Delhi Water Committee in their Report, Volume I, Page 20, Table II, Col. 3, is 993 cusecs.

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5. It is this omission of the comparison of rainfalls in the various districts, which leads to erroneous comparisons between canals. A very clear example of the effect of decrease of rainfall down a canal is provided in para. 13* of Executive Engineer on Special Duty's note. As the rainfall dropped from 12 inches at Balloki to 6 inches at Khanewal in the summer, and from 3 inches to $1\frac{1}{2}$ inches in the winter, so the delta or depth of canal water required to mature a crop rose from 2.8 to 3.6 feet in the summer and from 1.6 to 2.2 feet in the winter.

6. While it is realised that the restrictions in supplies in December to February have been based on the desire to keep the wells working, it is felt that the restriction is too severe and even in spite of all the wells working will result in an unnecessarily inferior outturn from the winter crops.

7. In conclusion, it is proposed, to assume duty on capacity of 80 in the summer and to assume 2.8 acres irrigation, per cusec-day, for water in the period 16th October to 10th of December, for the perennial distributaries, and a duty on capacity of 65 acres in the summer for the non-perennial distributaries with the ratio of summer to winter crops as 1 to 1.

J. D. H. BEDFORD—26-6-25,
Secretary Construction, Irrigation Branch, Punjab.

Will Secretaries North and South kindly favour me with their opinions as regards the proposals in the last para.

J. D. H. BEDFORD—26-6-25,

To Secretaries, North and South. Secretary, Construction, Irrigation Branch, Punjab.

Attached is a note dealing with the subject. Except as indicated therein I agree as to the irrigation forecast.

Regarding para. 7† of Secretary Construction's note above.

I do not understand this proposed duty on capacity (full supply factor) of 80 acres per cusec.

Take the Sidhnai area. Here you have a culturable commanded area of 377,863 acres, and a capacity for it of $\frac{420,000}{695,714} \times 2,300$ —say, 1,380 cusecs at distributary heads.

Capacity at outlets, 1,242 cusecs; 1 cusec of outlet capacity is thus available for $\frac{377,863}{1,242}$ —say, 300 acres culturable commanded area.

From my note,‡ it appears possible for the Sidhnai to irrigate, as it does at present in a good year, i.e., some 180,000 acres *rabi* and 138,000 acres *kharif*. These represent some 48 per cent. and 36 per cent. of the culturable commanded area in *rabi* and *kharif*, respectively.

Accepting the above figures, the distribution of outlet capacity should be:—

1 cusec outlet capacity to 300 acres culturable commanded area.

1 cusec outlet capacity to 144 *rabi* irrigation,

108 *kharif* irrigation, and

252 acres, annual irrigation.

or 84 per cent. of culturable commanded area.

The full supply factors are thus 108 *kharif* and 144 *rabi* at outlet head.

“ “ “ 97 “ 130 “ distributary head,
as against Sec. C.'s figure of 80 *kharif*.

The duties will be—

Kharif $\frac{97}{.85}$ say, 120.

Rabi $\frac{130}{.63\frac{1}{2}}$ say, 200.

F. J. WALLER—1-7-35.

Secretary, North, Irrigation Branch, Punjab,

To Secretary, Construction.

* Page 78.

† Above.

‡ Pages 88 and 89.

§ Time factor.

Copy of a note, dated the 1st July 1935 by Mr. F. J. Waller, C.I.E., Chief Engineer (Northern Administration), Irrigation Works, Punjab.

I have studied Mr. Kanwar Sain's interesting but complicated note without being able to find very much to which any objection can be taken.

2. I understand at the present juncture the object of the note is to try and forecast the probable irrigation of the Haveli project, and not to fix the future full supply factors, etc., for the design of distributaries. This being so, I would like to see the question approached in a somewhat more practical, and less scientific manner than has been done in the note.

3. The question is complicated by the fact that in the Haveli project an attempt is being made to force cultivators to retain their wells to mature the crops, i. e., continue the present Sidhnai practice.

4. Admitting that these are unusual factors to be considered such as an unusually large number of wells in the area and that there is less rainfall in the tract than other canals, I still think it is possible to arrive at a forecast of the probable irrigation from a consideration of the data of our other canals.

5. The supplies which the perennial portion of the Haveli project will receive are given in Appendix A-I, Statement III.* Assuming that the supply to be received, during December to February, will be 1,000† cusecs, these are as below :—

		At canal head. (cusecs).	Capacity factor. (Full supply discharge 2,750).
October	..	2,087	0.75
November	..	2,475	0.90
December	..	1,000	0.36
January	..	1,000	0.36
February	..	1,000	0.36
March	..	2,699	0.98
		10,261	
Mean <i>rabi</i> discharge	..	1,710	0.63

The mean capacity factor of the *rabi* works out to 0.63, a figure which compares favourably with those of other canals in the Punjab :—

		Capacity factors average 1923-33.	Average duty on mean supply at distributary heads.
Lower Jhelum canal	..	0.61	250 acres
Sirhind canal	..	0.56	200 "
Upper Bari Doab canal	..	0.44	300 "
Lower Chenab canal	..	0.65	265 "
Lower Bari Doab canal	..	0.56	200 "

The Upper Bari Doab canal with a duty of 300 has rain and wells to help out canal irrigation. The Lower Chenab and Lower Jhelum canals (duty 250) have some rain. The Lower Bari Doab canal (duty 200) has little or no rain and no wells. The Sidhnai has wells but no rain and a duty of 200 seems a possible proposition.

The Upper Bari Doab canal capacity factors during December-February are often lower than the 0.36 of the Haveli but this canal manages to mature the crop, and attains a duty as high as 300 acres per cusec. There are a large number of wells in the Upper Bari Doab canal area, which no doubt help towards the working with such low supplies and the attainment of this high duty of 300 acres per cusec.

6. I am not claiming any real similarity between the Upper Bari Doab canal and the proposed Haveli—a duty of 300 acres per cusec is an improbability in the Haveli tract—but I do think the figures show that it is possible to consider the prospects of the scheme on the supplies available, without trying to evaluate the assistance given by the wells. Even with the Haveli supplies it will be necessary for the cultivators to utilize their wells, if they wish to do the irrigation, they are at present doing.

7. *Forecast of perennial winter irrigation*—To consider the Sidhnai separately.

The gross perennial area on the Sidhnai is some 420,000 acres out of a total perennial area of 694,278 acres.

Of supplies at Trimmu the share of the Sidhnai area is $\frac{410,848}{694,278}$ or 60 per cent.

* Page 5.

† Actual figure, since recommended by the Delhi Water Committee in their Report, Volume I, page 20, Table II, column 3, is 990 cusecs.

APP. D-I

Allowing 10 per cent. loss between Trimmu and the Ravi, the supplies at head received by the Sidhnai area will be:-

	Total supplies available at Trimmu.	Sidhnai share at Trimmu.	Sidhnai at Ravi.	At distributary heads.
	(cusecs).	(cusecs).	(cusecs).	(cusecs).
October ..	2,087	1,252	1,127	1,044
November ..	2,475	1,485	1,317	1,238
December ..	1,000	600	540	500
January ..	1,000	600	540	500
February ..	1,000	600	540	500
March ..	2,699	1,619	1,458	1,349
Mean ..				855

If we compare these supplies, which the Sidhnai area is expected to receive with those given in statement VII* attached as the supplies received during the years 1920-1931, we find they are rather better than the Sidhnai receives on an average, but not as good as in some years, instance 1922-23, 1929-30 and 1931-32.

8. The best year is 1922-23 when in the winter the area irrigated was 204,727 and matured 191,333 acres; in other good years irrigation was 190,000 acres and area matured 165,000 acres.

9. Allowing for some reduction in *kharab* I do not think it would be safe to take more than 180,000 acres as the winter irrigation forecast for the Sidhnai area. The winter mean discharge at distributary heads for the Sidhnai area under the Haveli project is 855 cusecs, and this means a duty at distributary head of $\frac{180,000}{855} = 208$ acres per cusec, which is as much as the project is ever likely to attain. Allowing for a summer irrigation of some 150,000 acres, this means cultivation annually of some 90 per cent. of the culturable commanded area.

10. Considering the rest of the perennial area some 90,867 acres transferred from non-perennial and 183,411 acres other area, and assuming duties similar to that arrived at for the Sidhnai in paragraph 9, we obtain the following as a forecast of winter irrigation in the perennial area:

	Gross area.	Culturable commanded area.	Authorized full supply discharge at distributary heads.	Mean winter discharge at distributary heads.	Duty.	FORECAST OF IRRIGATION.	
						First five years.	After.
Sidhnai ..	acres. 420,000	acres. 377,803	cusecs. 1,380	cusecs. 803	acres. 180-208	acres. 155,310	acres. 179,504
Non-perennial area ..	90,867	81,780	206	186	150-200	27,000	37,260
Other area ..	183,411	114,370	624	303	100-200	30,300	78,600
Total ..	694,278	574,213	2,300	1,412	..	222,540	295,300

As will be seen the winter irrigation forecast is 222,540 acres for the first five years with ultimate 295,300 acres as against Executive Engineer on Special Duty's 263,813† and 295,470† acres.

Forecast of perennial summer irrigation.

11. During the summer the Sidhnai area share of the supply at head of canal will be $2,750 \times 0.6 = 1,650$ cusecs. Allowing 10 per cent. for loss between Trimmu and the Ravi say 1,485 cusecs as the supply comparable with what this area receives at present.

This is a considerable improvement on the supplies at present received. In a good year the Sidhnai irrigates a summer area of about 150,000 acres and matures 120,000 acres—the area cultivated is about 40 per cent. of the total culturable commanded area.

Some improvement as regards maturing of the area sown may be looked for, but for forecast purposes, I would not assume more than about 140,000 acres, as the culturable commanded area available does not appear to allow of more.

* Page 98.

† Page 79.

12. The forecast for irrigation in summer will be as below :—

	Gross area.	Mean supply at distributary heads.	Duty.	PROBABLE IRRIGATION.	
				First five years.	Ultimate.
Sidhnai area ..	acres. 420,000	cusecs. 1,380	acres. 100	acres. 138,000	acres. 138,000
Non-perennial area ..	90,867	296	80—100	24,000	30,000
Other area ..	183,411	624	80	50,000	50,000
				212,000	218,000

My summer irrigation forecast is thus 212,000 and 218,000 acres as against Executive Engineer on Special Duty's 161,000* and 184,000* acres.

The annual irrigation forecast compares as below :—

	FIRST FIVE YEARS.			ULTIMATE (AFTER TEN YEARS).		
	<i>Kharif</i> .	<i>Rabi</i> .	Total.	<i>Kharif</i> .	<i>Rabi</i> .	Total.
	acres.	acres.	acres.	acres.	acres.	acres.
Secy. North ..	212,000	222,500	434,500	218,000	295,300	513,300
Executive Engineer on Special Duty ..	161,000	263,813	424,813	184,000	295,470	479,470

My *kharif* forecast is more and *rabi* about the same as, that of Executive Engineer on Special Duty. My annual irrigation is slightly more.

Forecast of non-perennial.

13. The area forecast by the Executive Engineer on Special Duty is on the following data :—

	Gross area.	Approximate culturable commanded area.	EXISTING IRRIGATION.	PROPOSED IRRIGATION.	
			Annual.	Summer.	Winter.
	acres.	acres.	acres.	acres.	acres.
Old area ..	420,000	378,000	240,000	<u>121,000</u> 143,000	<u>121,000</u> 143,000
New area ..	442,500	322,000	Nil	<u>108,000</u> 127,000	<u>108,000</u> 127,000

So far as the old area goes no more is forecast to begin with, than is done at present and the ultimate increase proposed is small, although it means increasing the ultimate intensity to about 77 per cent. of the culturable commanded area. This may be possible in the old areas, but I doubt it as regards the new areas, where development is likely to be slow.

In these new areas, I would allow for an ultimate development of irrigation to 50 per cent. of the culturable commanded area, to be worked up to in 10 years. The forecast for summer irrigation in the non-perennial area will thus be:—

			Summer (acres.)	Winter first waterings (acres.)
1st year	Old area	..	121,000	121,000
	New area	..	8,000	8,000
			129,000	129,000
5th year	Old area	..	143,000	143,000
	New area	..	40,000	40,000
			183,000	183,000
10th year	Old area	..	143,000	143,000
	New area	..	83,000	83,000
			226,000	226,000

My ultimate forecast is thus about what Executive Engineer on Special Duty forecasts in the 1st five years, but some 44,000 acres less than his ultimate figure.

14. To sum up.

Perennial channels.—There is unlikely to be any increase in the Sidhnai area beyond what is due to a decrease in *kharaba*. The extra revenue will have to come from the increase in water-rates on the existing irrigated area. It should be borne in mind, that, despite the giving of better supplies, there is always the possibility that as a result of the increase in water-rates under present economic conditions there may be a reduction of area irrigated—the Sidhnai cultivator may prefer to do purely *nahri* and *chahi* rather than *chahi-nahri* irrigation leading to a diminution in the *nahri* area.

In the area, transferred from non-perennial, some 90,867 acres gross, there should be an increase in irrigated area—the return will be both from the increased area and increased water-rates.

In the new area, some 183,411 acres gross, development is likely to be slow and we need to be cautious in our expectations.

Non-perennial area.—In the old area the return will be from increased water-rates rather than increased irrigation.

In the new areas development is likely to be slow and you need to be cautious in your expectations.

F. J. WALLER—1-7-35.

Secretary, North
Irrigation Works, Punjab.

To Secretary, South.

T. B. TATE—2-7-35.

Secretary, South
Irrigation Works, Punjab.

To Secretary, Construction.

Note, dated the 2nd July 1935, by Mr. J. D. H. Bedford, Chief Engineer,
(Construction Administration), Irrigation Works, Punjab.

The statement below compares figures of irrigation as proposed and as modified :—

	PERENNIAL AREAS.		NON-PERENNIAL AREAS.	
	(Acres.)		(Acres.)	
<i>First year's irrigation forecast</i>	Summer.	Winter.	Summer.	Winter.
As proposed ..	161,000	263,813	229,190	229,190
As accepted by other Secretaries ..	212,000	222,540	129,000	129,000
Difference ..	+ 51,000	—41,300	—100,000	—100,000
<i>Ultimate irrigation forecast.</i>				
As proposed ..	184,000	295,470	270,860	270,860
As accepted by other Secretaries ..	218,000	295,300	226,000	226,000
Difference ..	+34,000	..	—44,860	—44,860

After a thorough examination of surrounding circumstances the proposals, as put up did not go beyond postulating that with a known quantity of water the probable irrigation in summer and winter would be such and such. It was not intended to claim the areas of irrigation to be obtained for the Right bank non-perennial canal. Future irrigation in this tract is much more uncertain than for the Left bank canals, because the Right bank canal is long and passes through difficult country, and is unlikely to show the same efficiency as the Left bank canals.

After approval of the proposed figures, based on general principles, it was intended to make a specific reduction in forecast figures for irrigation for the Right bank canals. It was proposed to take as ultimate irrigation $\frac{1}{3}$ gross area of *kharif* on Left bank non-perennial canal area, i.e., $\frac{449,299}{3} = 149,700$ and $\frac{1}{4}$ gross area of *kharif* on Right bank canals

$$= \frac{313,253}{4} = 78,300. \text{ This gives a total of } 228,000 \text{ acres.}$$

This is practically the same as the figures given by other Secretaries and may be accepted. For the forecast of ultimate perennial irrigation, other Secretaries give a figure of 34,000 acres in excess of my figures. May accept other Secretaries' figures.

There is a considerable difference in opinion regarding probable irrigation in non-perennial areas in the early years of development. Where channels exist at present, there is really no reason why irrigation should not respond quickly to increase in water supplies in the sowing periods, but after all the lower figures do provide a factor of safety and may be accepted. The increase between first year's figures and ultimate figures may be divided equally in the 10 years period of forecast.

In this case particular attention was directed to see that the canal water supply plus well water is sufficient to mature *rabi* crops sown on canal water.

Statement No. VIII* shows the proposed figures of gross, culturable commanded, and probable irrigation areas on the Haveli canals.

J. D. H. BEDFORD—2-7-1935.
Chief Engineer, Construction;
Irrigation Works, Punjab.

APPENDIX D-I, STATEMENT I WORKING STATISTICS OF DISTRIBUTARIES OF JIANG DIVISION OF LOWER CHENAB CANAL

Year.	Gross area.	Culturable commanded area.	Kharif.				Rabi.				Rainfall.				
			Area irrigated.	Capacity of dyke.	Kharif duty.	Duty based on capacity of dyke.	Area irrigated.	Rabi duty.	Irrigated area.	Days of watering per acre.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1902-06	703,320	550,250	84,875	1,504	60	51.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1906-07	703,310	550,240	84,885	1,504	60	51.8	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1907-08	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1908-09	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1909-10	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1910-11	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1911-12	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1912-13	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1913-14	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1914-15	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1915-16	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1916-17	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1917-18	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1918-19	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1919-20	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1920-21	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1921-22	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1922-23	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1923-24	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1924-25	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1925-26	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1926-27	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1927-28	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1928-29	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1929-30	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1930-31	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1931-32	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16
1932-33	703,316	550,240	84,891	1,504	60	52.2	11,201	14,668	24,256	71.15	14.25	15.35	7,850	15	16

APPENDIX D-I, STATEMENT II

WORKING STATISTICS OF DISTRIBUTARIES OF KHANWAL DIVISION OF LOWER BARI DOAB CANAL.

Year.	Gross area.	Culturable commanded area.	Kharif.					Rabi.					Rainfall.			
			Area irrigated.	Capacity of distys.	Kharif duty.	Duty based on capacity of distys.	Area irrigated Gross area.	C. C. A. %	Area irrigated.	Rabi duty.	Area irrigated Gross area.	C. C. A. %	Discharge in rabi sowing period at disty. heads + October + November + December.	Rabi area irrigated in sowing period (at disty. heads)	April to 30th September.	October, November, & December.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Acres.	Acres.	Acres.	Acres.	Cusecs.	Acres.	%	%	Acres.	Acres.	%	%	Cusecs-days.	Acres.	Inches.	Inches.	
1916-17	476,322	380,174	61,388	1,185	82	12.88	17.05	60,847	159	14.05	18.5	25,133	2.66			
1917-18	319,647	240,143	31,620	1,093	94	10.15	20.72	59,028	112	18.47	23.7	35,315	1.07			
1918-19	403,132	331,401	63,429	1,498.6	82	15.73	10.14	68,013	91	10.85	20.5	29,150	2.33			
				Average..	86	11.92	18.91	64,629	122	16.45	20.9	29,865	2.22			
1919-20	410,307	335,751	90,384	1,558	81	23.18	28.71	87,531	97	21.3	20.1	46,442	1.88	0.24	0.75	
1920-21	410,307	335,754	102,402	1,558	74	24.0	30.6	76,074	130	18.35	22.7	34,141	2.23	5.06	..	
1921-22	410,307	339,109	99,998	1,556	91	24.4	28.6	100,072	130	20.4	32.1	48,143	2.20	2.07	1.30	
				Average..	82	21.26	29.30	90,899	124	22.08	27.0	42,909	2.12	4.76	0.38	
1922-23	590,986	455,926	138,079	2,054	82	23.5	30.0	170,277	143	28.8	38.0	63,027	2.07	5.39	0.21	
1923-24	590,170	468,547	148,379	1,915.6	100	24.9	31.6	164,197	146	27.6	35.0	60,921	2.40	5.81	..	
1924-25	590,170	468,547	160,549	1,945.6	110	26.9	34.0	163,427	145	27.9	30.0	71,567	2.36	7.36	0.05	
				Average..	97	25.5	31.87	163,967	145	28.1	36.3	67,372	2.50	6.19	0.09	
1925-26	596,176	469,453	180,974	1,915.3	105	30.3	30.0	174,734	190	29.3	30.0	69,531	2.51	0.29	..	
1926-27	595,961	471,664	189,413	1,907	101	31.8	40.0	169,980	182	28.5	30.0	56,284	3.02	7.61	0.01	
1927-28	595,961	472,174	181,586	2,002	104	30.7	38.0	181,539	185	30.5	38.0	58,182	3.12	3.01	0.94	
1928-29	595,961	472,174	177,985	2,013	117	29.9	37.0	189,182	166	31.7	40.0	74,377	2.55	2.80	0.52	
				Average..	106	30.6	38.0	178,861	181	30.5	37.0	64,594	2.80	4.94	0.37	
1929-30	595,961	472,174	165,796	2,002	111	27.8	35.0	204,664	167	34.35	43.0	78,422	2.62	10.57	0.38	
1930-31	595,961	472,174	164,467	2,002	104	27.6	35.0	199,827	178	33.6	42.0	73,195	2.73	0.31	..	
1931-32	604,566	480,006	156,988	1,927	91	25.9	33.0	194,726	171	32.0	40.0	73,083	2.63	4.38	0.24	
1932-33	859,132	628,395	232,860	2,865	97	27.1	37.0	250,128	171	20.1	40.0	75,756	3.31	2.99	0.15	
				Average..	100.8	27.1	35.0	212,336	172	32.26	41.0	75,114	2.82	6.06	0.19	

APPENDIX D-1, STATEMENT III

WORKING STATISTICS OF DISTRIBUTARIES OF SIDHAI CANAL (EXCLUDING SUBSIDIARY CANALS)

Year.	Kharif.						Rabi.						RAINFALL.		
	Culturable commanded area.	Area irrigated.	Capacity of distys.	Kharif duty.	Duty based on capacity of distys.	Irrigated area. %	Irrigated area. %	Area irrigated.	Rabi duty.	Irrigated area.		Discharge in rabi sowing period at disty. heads + October, + November, + December.	Rabi area irrigated in sowing period (at disty. heads)	Rainfall.	
										Acres.	Cusecs.			Acres.	Cusecs.	Acres.	Inches.	Acres.	Inches.
1	3	1	5	6	60-1*	7	8	9	10	11	12	13	14	15	16
1003-06	278,088	38,250	1,820	..	21-05	12-16	13-85	103,580	..	33-65	37-23	25,316	4-10	..	..
1006-07	278,088	63,982	1,820	..	35-15	20-80	23-00	131,602	..	42-78	17-35	59,628	2-21	..	..
1007-08	278,088	55,315	1,820	..	30-10	17-98	19-89	21,631	..	7-03	7-78	1,375	1-37	..	..
1008-09	278,088	50,700	1,820	..	32-80	19-10	21-48	101,225	..	33-88	37-50	22,320	4-67	..	..
1009-10	278,088	101,306	1,820	..	33-68	32-80	30-10	137,550	..	44-65	39-15	41,336	3-09	..	..
1010-11	278,088	86,593	1,820	..	17-01	28-15	31-20	129,716	..	42-12	46-62	32,688	3-97	..	..
1011-12	278,088	104,249	1,820	..	37-12	21-93	24-30	..	..	31-02	37-66	..	2-60	..	..
1012-13	278,088	107,055	1,820	..	57-29	33-87	36-20	111,513	..	36-22	10-10	9,261	12-04	..	..
1013-14	278,088	108,062	1,820	..	58-80	31-80	38-18	116,297	..	37-77	41-80	10,697	10-88	..	..
1014-15	278,088	120,717	1,820	..	59-30	35-35	30-12	111,692	..	37-27	11-25	1,292	88-78	..	..
1015-16	278,088	103,519	1,820	..	60-32	39-20	13-10	103,511	..	33-11	38-80	32,155	3-12	..	..
1016-17	278,088	101,432	1,820	..	56-00	33-01	37-21	120,163	..	41-05	15-45	25,712	4-91	..	..
1017-18	278,088	116,099	1,820	..	53-71	32-90	30-50	150,412	..	50-80	56-2	37,002	4-21	..	..
1018-19	278,088	105,368	1,820	..	63-80	37-70	41-75	180,332	..	51-08	57-60	50,143	3-20	..	..
1019-20	278,088	113,093	1,820	..	37-92	31-20	37-81	90,179	..	29-30	32-58	3,588	25-13	..	..
1020-21	278,088	114,406	1,820	..	62-80	37-15	11-10	128,719	..	41-80	16-27	15,710	8-18	..	..
1021-22	321,001	76,011	1,820	Average	60-52	35-53	39-17	..	..	39-97	14-36	..	3-16	..	..
1022-23	321,001	108,610	2,100	162	41-78	22-20	23-65	133,368	356	38-90	41-40	20,132	6-62	4-11	0-36
1023-24	321,001	108,006	2,100	110	51-71	31-70	33-78	172,805	170	50-15	37-52	61,830	2-70	1-02	0-07
1024-25	321,001	113,351	2,100	86	70-12	48-08	35-80	137,139	211	10-10	42-70	29,028	4-23	7-25	0-06
1025-26	321,001	101,209	2,100	116	51-90	33-75	32-38	169,973	218	47-10	50-0	52,198	3-08	8-91	0-19
1026-27	321,001	125,028	2,100	126	49-60	30-50	32-38	165,004	278	18-30	51-28	46,224	3-57	4-61	..
1027-28	321,001	94,330	2,100	99	54-23	30-60	38-85	159,325	254	40-6	40-5	51,501	3-08	3-80	..
1028-29	321,001	125,032	2,100	131	43-30	20-71	29-33	127,803	319	37-10	30-60	18,008	7-90	3-89	0-85
1029-30	321,001	120,367	2,100	99	59-51	32-60	38-85	150,080	282	36-88	39-15	50,121	6-16	2-79	0-68
1030-31	321,001	116,812	2,100	157	57-11	35-20	37-39	158,791	193	46-53	19-32	32,501	4-88	16-01	0-51
1031-32	321,001	115,290	2,100	102	53-31	31-20	30-30	120,300	405	35-20	37-38	50,010	7-19	7-19	0-78
1032-33	321,001	69,023	2,100	122	51-88	23-71	35-80	170,878	293	50-00	53-95	40,731	3-43	6-00	..
1033-34	321,001	136,161	2,100	116	61-80	28-93	30-75	115,621	372	33-85	53-95	12,106	9-48	3-52	..
1034-35	321,001	..	2,100	..	61-80	30-82	42-20	171,611	..	50-20	53-18	..	3-19	6-92	0-46
1035-36	321,001	..	2,100	Average	56-10	33-74	36-76	..	..	43-19	16-13	..	..	..	..

Column 14.—Figures in bold are omitted, while working out the averages.

* Duty on capacity on Sidhail canal is too low, on account of the available supply being much less in critical periods than the capacity of channels.

APPENDIX D-I, STATEMENT IV

STATEMENT SHOWING THE PRINCIPAL IRRIGATION DATA OF THE PERENNIAL DISTRIBUTARIES
ON THE PUNJAB CANALS

CANAL.	DATE OF YEAR 1929-30.				TEN YEARS' AVERAGE (1920-21—1929-30).											
	Gross area.	C. C. A. gross area.	Typicity allow- ance of C. C. A. (disty.)	Proposed intensity on C. C. A.	Capacity factor.		Mean supply % of area C. C. A.		Intensity on C. C. A.			Duty.		Full supply factor.		
					Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Total.	Kharif.	Rabi.	Kharif.	Rabi.	Total.
1	2	3	4	5	6 (a)	6 (b)	7 (a)	7 (b)	8 (a)	8 (b)	8 (c)	9 (a)	9 (b)	10 (a)	10 (b)	10 (c)
	Acres	%	Cusecs	%			Cusecs	Cusecs	%	%	%	Acres	Acres	Acres	Acres	Acres
Western Jumna canal ..	2,076,817	84	2.58	38.0	0.18	0.11	1.3	1.1	16.0	20.6	37.5*	137	188	66	80	146
Upper Bari Doab canal ..	1,402,177	87	3.91	83.3	0.79	0.43	2.0	1.6	43.0	47.0	90.0	145	305	114	126	240
Sirhind canal (British) ..	2,288,498	85	2.37	39.8	0.63	0.61	1.5	1.4	23.7	32.8	56.5*	160	233	101	111	212
Lower Chenab canal ..	3,347,031	79	3.34	67.5	0.79	0.71	2.6	2.4	31.0	63.0	97.0	131	264	103	186	289
Lower Jhelum canal ..	1,340,615	92	2.70	61.8	0.70	0.61	2.0	1.8	25.0	44.0	69.0	133	247	92	156	248
Lower Bari Doab canal ..	1,711,172	86	3.89	66.6	0.79	0.57	3.1	2.2	35.0	42.0	77.0	113	187	89	106	195
Sidhnai canal (excluding Sub- sidiaries) ..	341,617	94.3†	6.37	69.0	0.47	0.27	3.0†	1.8	35.6	43.7	79.3	117	217	..	..	106
PROPOSED HAVELI CANALS (Perennial) ..	691,278	83‡	4.0	80.4	0.08‡	0.53‡	3.97‡	2.5‡	32.2	51.8	81.0	81.5‡	204‡	80	129	209.5

NOTES.—*On these two canals, a lot of area is sown as "barani" even if canal water is available. If this "barani" area is also taken into consideration, the resulting intensities of cropping would be very much higher.

†C. C. A. allowed in the project for the old areas on the Sidhnai including subsidiary canals is 90 per cent of gross area.

‡Based on mean available supply, with 1,000 cusecs limit during December, January, and February.

COMPARISON OF PROPOSED NON-PERENNIAL DISTRIBUTARIES OF HAVELI PROJECT WITH THE EXISTING INUNDATION CANALS IN THE SAME AREA

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APPENDIX D-1, STATEMENT VII

DATA OF SIDHAI CANALS (INCLUDING THE KORANGA, FAZILSHAH AND ABDUL HAKIM SUBSIDIARY CANALS)

Year.	TOTAL MEAN DISCHARGE.		Gross area commanded.	DISCHARGE PER % ACRES OF GROSS COMMANDED AREA.		DISCHARGE BY MONTHS (CUSECS).												AREA IRRIGATED.			AREA WATERED.		
				Kharif.	Rabi.	Kharif.						Rabi.						Kharif.	Rabi.	Total.	Kharif.	Rabi.	Total.
	Cusecs	Rabi.				April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.						
1920-21 ..	Cusecs 1,467	Cusecs 71	Acres. 380,077	3.85	0.02	1290	1201	1301	1308	1180	1450	311	112	..	..	..	..	Acres. 122,688	Acres. 57,318	Acres. 210,006	Acres. 77,060	Acres. 31,912	Acres. 112,572
1921-22 ..	577	431	420,717	1.37	1.02	..	..	..	..	1371	2105	932	104	212	418	769	96	96,567	157,246	214,053	60,035	133,210	193,245
1922-23 ..	1,101	1,100	420,717	2.61	2.82	270	344	551	1074	2024	1438	1610	1368	459	878	1450	1352	121,818	204,727	329,545	93,712	191,333	285,045
1923-24 ..	1,593	731	420,717	3.78	1.73	1336	1060	1118	2150	773	2190	984	459	211	191	1418	1097	136,611	160,617	297,258	112,291	144,267	256,558
1924-25 ..	1,163	861	419,818	2.77	2.05	1119	576	282	1830	1726	1101	1813	812	802	632	518	526	133,696	190,573	324,069	119,698	167,666	287,364
1925-26 ..	973	653.7	419,818	2.82	1.56	127	423	681	1983	609	2055	1190	880	533	327	151	833	119,969	193,145	313,111	95,298	164,134	260,132
1926-27 ..	1,101	694	419,818	3.18	1.65	641	1631	1083	1028	1611	1182	1760	838	595	131	210	298	118,481	181,008	332,489	120,021	157,754	277,775
1927-28 ..	831	406	419,818	1.97	0.96	164	136	194	1071	1392	1725	795	181	51	2	600	802	165,766	147,770	253,539	75,905	115,184	190,989
1928-29 ..	1,547	169	419,818	2.68	1.11	568	1207	1719	1905	2222	1571	677	101	779	322	153	178	108,718	141,059	202,777	98,800	106,035	204,835
1929-30 ..	928	937	419,818	2.21	2.23	37	223	889	1500	1078	1753	1146	331	680	1218	743	1500	110,887	180,001	327,488	90,970	102,016	238,992
1930-31 ..	1,400	313	419,818	3.33	0.74	562	1604	1718	1102	1372	1084	836	234	123	49	188	442	138,009	135,362	274,031	90,486	89,401	179,887
Average ..	1,186	614.5	..	2.81	1.44	556	824	1005	1511	1432	1712	1058	501	108	108	560	675	127,915	161,933	290,761	91,680	133,275	227,945
Haveli Project (1932).	1,128	630	..	3.4	1.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Haveli Project (1935.)	1486*	924*	..	..	..	..	..	..	..	..	..	1127*	1337*	540*	540*	540*	1158*	..	..	..	..	..	..
	1375†	855†	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* At Havi

† At distributory heads

APPENDIX D-I, STATEMENT VIII

STATEMENT SHOWING DETAILS OF GROSS, CULTURABLE AND PROBABLE IRRIGATION
AREAS ON THE HAVELI CANALS, AS ACCEPTED BY THE THREE CHIEF
ENGINEERS FOR THE 1935 PROJECT

Classification of areas.	Gross area.	Percentage of gross area for culturable irrigable area.	Culturable irrigable area.	Intensity of annual irrigation on C. C. A.	Ultimate annual irrigation.	Existing irrigation average of 10 years (1922-23 to 1931-32).
I	2	3	4	5	6	7
	Acre.	%	Acre.	%	Acre.	Acre.
PERENNIAL IRRIGATION.						
-Old areas :-						
Existing semi-perennial areas ..	419,848	90	377,863	89.4	337,800	313,000
Transfer from inundation ..	90,867	90	81,780	89.4	73,111	42,000
-New areas :-						
Proprietary ..	18,464	85	15,694	89.4	14,030	..
Government (fit for cultivation) ..	70,472	87.5	60,448	89.4	62,086	..
Government (inferior lands) ..	22,002	90.0	20,693	89.4	18,499	..
Government (bad lands) ..	52,359	..	..	..	..	..
Proprietary (lift irrigation) ..	10,276	85	8,735	89.4	7,809	..
Total ..	694,278		574,213	89.4	513,344	..
% of irrigation on gross area = 74%.						
NON-PERENNIAL IRRIGATION (LEFT BANK).						
Existing inundation areas ..	312,056	90	281,660	82.0	230,187	145,000
New areas proprietary ..	135,086	80	108,068	60.0	64,841	..
New areas Government (fit for cultivation) ..	1,450	85.5	1,240	63	783	..
New areas (inferior lands) ..	1,663	..	..	..	..	..
Total Left bank (non-perennial) ..	451,155		390,968		295,811	
% of irrigation on gross area = 65.5%						
NON-PERENNIAL IRRIGATION (RIGHT BANK).						
Existing inundation areas ..	107,164	90	96,448	50	48,224	54,000
New areas proprietary ..	242,619	80	194,095	50	97,048	..
New areas Government (fit for cultivation) ..	20,327	85.5	17,380	63	10,917	..
New areas (inferior lands) ..	41,284	..	..	..	..	..
Total Right bank (non-perennial) ..	411,394		307,923		166,189	
% of irrigation on gross area = 35%.						
Gross total (non-perennial) ..	862,549		698,891		462,000	

APPENDIX D-II

PROBABLE AREA OF IRRIGATION FROM THE MONTGOMERY-PAKPATTAN LINK

1. A general discussion on proposed duties of irrigation for the Haveli has been given in Appendix D-I.* The recommendations are as follows:—

(a) For summer crops, a "duty on capacity" of 80.

(b) For winter crops, a proposed irrigation of 2.8 acres per cusec-day of water from the 16th October to the 10th December at distributary heads.

2. The winter irrigation forecast in the Sutlej Valley Project Completion Report, 1935, although worked out on somewhat different lines to that of the Haveli, gives the following results:—

From page 150 of this Report, we get water available for Pakpattan canal from the 16th October to the 10th December as 119,000 cusec-days, and from page 147, the area of winter irrigation is 290,000 acres. Irrigation per cusec-day is then 2.42 acres. In this calculation the water is in the river at the head of canals. To compare this figure of 2.42 acres with the Haveli figure of 2.8, we must increase it by 20 per cent. to allow for absorption losses in the main canal and branches, and this brings it up to 2.9 acres per cusec-day at distributary head as compared with 2.8 acres allowed for in the Haveli, a close agreement, considering that the investigations were on different lines and absolutely independent of each other. To keep our proposals in line with the Haveli, we shall take 2.8 acres per cusec-day for the winter crops.

Kharif Irrigation.

3. The summer "duty on capacity" in the Haveli forecast is 80 acres. The calculations given below indicate that we can safely take this figure for the supply given to the Pakpattan canal from Bulloki in April and May. The additional supply to Pakpattan canal is required only in the sowing months of April and May. From June onwards ample supply is available in the Sutlej.

We can take credit for 61 days. One cusec flowing for one day will cover an acre to a depth of 2 feet. Crops including cotton require 3 waterings in April and May combined, i.e., one-third of the water will be used for sowing and two-thirds for keeping the crop alive. Assume a depth of 4 inches in the field, add 10 per cent. for absorption in water-courses and another 10 per cent. for absorption in distributaries, i.e., the depth for watering may be taken as 4.8 inches. Therefore, one cusec-day will do $1/3 \times 12/4.8 \times 2 = 1.7$ acres of sowing. The water available is 738 cusecs in April and 705 cusecs in May (See Appendix A-II, Statement II)†, but only 700 cusecs may be taken for the forecast. Deducting 10 per cent. for loss in canal and the link, the net water at distributary head is equal to 630 cusecs in April and May. This means 38,430 cusec-days. The *kharif* irrigation will then be $38,430 \times 1.7 = 65,331$ acres, but with a duty of 80 on 700 cusecs capacity, we get 56,000 acres only, and this figure may be accepted for *kharif* irrigation.

Rabi Irrigation.

4. The number of cusec-days from the 16th October to the 10th December, after deducting 10 per cent. for absorption, is 25,865, vide Statement 1‡ of this Appendix. *Rabi* irrigation will be $25,865 \times 2.8 = 72,400$ acres.

5. The total annual increase in irrigation is $(56,000 + 72,400) = 128,400$ acres.

J. D. H. BEDFORD—26-6-1935.

Secretary, Construction.

Will Secretaries, North and South, kindly consider the proposals for Montgomery-Pakpattan-Link duties along with those in Haveli proper.

J. D. H. BEDFORD,

Secretary, Construction.

To Secretaries, North and South.

56,000 acres is probably a reasonable forecast on a steady supply of 700 cusecs in April and May, provided this supply is also available during the rest of the summer.

72,400 acres is a fair assumption for winter irrigation provided a supply of some 400 cusecs per month is available in the other months of the winter season for the intermediate and final waterings.

F. J. WALLER—29-6-1935.

Secretary, North.

T. B. TATE—2-7-1935.

Secretary, South.

To Secretary, Construction.

APP. D-II

As shown in Statement II* of Appendix A-II, the supply available in other months of the winter season is in no case less than 400 cusecs. The figures of irrigation as accepted by the other Secretaries have been taken as the basis of the revenue forecast.

KANWAR SAIN—3-7-1935.

*Executive Engineer on Special Duty,
Haveli Project.*

Work is expected to be completed in 3 years. Hence we can assume irrigation to start in *Kharif* of the 4th year. Water will be immediately available, because Punjab share of Chenab water exists at present and can be taken, whenever available in the river at Marala, down Upper Chenab canal to Balloki pending completion of Haveli works. When Chenab water is required for Haveli, then the Sidhna share of water at Balloki will be available to replace the Chenab water cut down. In the winter, most of the Trimmu supply is from regeneration, hence we cannot allow of much development until Haveli is in operation. Water will be supplied to channels in full working order and in excellent condition, hence there is no need to allow for a long and slow development. The irrigation expected should be realised in 5 years as suggested below :—

						Acres.
1st Year	..	..	..	..	..	20,000
2nd	..	..	..	..	..	40,000
3rd	..	..	..	..	..	70,000
4th	..	..	..	..	..	100,000
5th	..	..	..	..	..	128,000

J. D. H. BEDFORD,
Secretary, Construction.

APPENDIX D-II—STATEMENT I

STATEMENT SHOWING THE SHARES OF BURALA BRANCH EXTENSION AND MONTGOMERY-PAKPATTAN LINK OF THE AVERAGE SUPPLY AVAILABLE AT BALLOKI IN THE RABI SOWING PERIOD (THE 16th OCTOBER TO THE 10th DECEMBER).

Period.	Average supply available at Balloki (Average of 12 years 1922-23 to 1933-34) Cusecs.	SHARE OF BURALA BRANCH EXTENSION.				SHARE OF MONTGOMERY-PAKPATTAN LINK.			
		At head of Burala branch (Cusecs).	Deduct absorption in the Br. at 10% (Cusecs).	Available for utilization at disty. heads (Cusecs).	Utilizable supply at disty. head (Cusecs-days).	At Balloki Head (Cusecs).	Deduct absorption at 10% (Cusecs).	Available for utilization at disty. heads (Cusecs).	Utilizable supply at disty. heads (Cusecs-days).
1	2†	3†	4	5	6	7†	8	9	10
October 16th to 20th ..	953	329	33	296	1,480	624	62	562	2,810
21—31 ..	840	290	20	261	2,871	550	55	495	5,445
November 1—10	748	259	20	233	2,330	489	49	440	4,400
11—20 ..	711	246	24	222	2,220	465	46	419	4,190
21—30 ..	716	247	25	222	2,220	469	47	422	4,220
December 1—10 ..	814	281	28	233	2,530	533	53	480	4,800
				Total ..	13,051			Total ..	25,865

* Page 8.

† Figures in these columns are taken from Appendix A-II—Statement II Page 8.

APPENDIX D-III

PROBABLE AREA OF ADDITIONAL IRRIGATION DUE TO BURALA BRANCH
EXTENSION BEING CONVERTED INTO A PERENNIAL CHANNEL.

In the summer a supply of 370 cusecs capacity is available at Burala branch head. The capacity of the Burala Branch Extension distributaries is 313 cusecs. It is not intended to enlarge these channels, hence for purposes of irrigation forecast in the summer we may work on 313 cusecs.

It has been shown in Appendix D-I,* that a duty of 80 on distributary capacity is a moderate forecast for the Haveli areas. It will be still more moderate for the Burala Branch Extension areas.

The forecast of summer irrigation, therefore, is $313 \times 80 = 25,040$ acres. But the present non-perennial distributaries are doing 24,124 acres, which is nearly upto their full summer quota. There is no reason why the non-perennial channels should not in time do 25,040 acres irrigation in summer; hence we can take no credit for summer crops.

In Appendix D-I, 2.8 acres winter irrigation per cusec-day for the period, 16th October to 10th December, has been accepted as moderate for the Haveli areas. This will be still more moderate for the Burala Branch Extension areas.

Statement I† attached to Appendix D-II shows that 13,651 cusec-days are available at the head of distributaries from the 16th October to the 10th December for winter irrigation on the Burala Branch Extension. The final forecast of winter irrigation is then $13,651 \times 2.8 = 38,200$ acres.

The channels are ready and in good condition, complete with all necessary establishment. Hence development of irrigation will be rapid and may be as suggested below:—

						Acres.
1st Year	..	..	..	..	..	20,000
2nd "	..	..	..	..	..	30,000
3rd "	..	..	..	..	..	38,200

starting from the year Haveli is in operation, *i.e.*, the sixth year.

KANWAR SAIN,

Executive Engineer on Special Duty, Haveli Project

* Page 79.

† Page 101.

REVENUE FORECAST

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APPENDIX E-I

**DETAILS OF CROWN WASTE LANDS ON THE HAVELI CANALS AVAILABLE
FOR COLONIZATION AND THE RATES FOR SALE, MALIKANA AND
TEMPORARY CULTIVATION.**

Note, dated the 18th June 1935, by Mr. J. D. H. Bedford, Chief Engineer, Construction
Administration, Irrigation Works, Punjab.

The total gross area of Crown waste lands in the area covered by the Haveli Project is as follows:—

				Acres.
Jhang district	..	..	..	51,605
Multan district	..	..	..	140,038
Muzaffargarh district	..	..	..	27,903
Total				219,546

Cut of this area, 215,287 acres have been soil surveyed by either the Agricultural Department or the Director of Irrigation Research Institute. Out of 4,259 acres for which no soil survey was done, 631 acres are on temporary cultivation, and 1,798 acres on *Tahudkhahi* terms. Only these areas, at present given out on temporary cultivation or *Tahudkhahi* terms, are considered as fit for cultivation, out of 4,259 acres to be on the safer side.

The result of the soil surveys is given below:—

Name of District.	GOOD LANDS.		INFERIOR LANDS.		BAD LANDS.	
	L. Bank.	R. Bank.	L. Bank.	R. Bank.	L. Bank.	R. Bank.
Jhang	Acres. 11,861	Acres. 15,792	Acres. 3,713	Acres. 6,358	Acres. 2,323	Acres. 11,553
Multan	69,060	..	19,270	..	51,609	..
Muzaffargarh .. ..	..	4,535	..	2,045	..	20,723
Total	80,921	20,327	22,992	9,003	54,022	32,281

Out of 80,921 acres of good land on the left bank, an area of 1,450 acres is non-perennial, leaving a balance of 79,471 acres as perennial. The area of good land which is non-perennial is $20,327 + 1,450 = 21,777$ acres.

For purposes of a revenue forecast we will only consider good land, although the inferior lands* are said to be cultivable after a preliminary rice crop. These inferior lands could be given out on peasant terms.

In Sutlej Valley project forecast (Statement I, page 123 of the Completion Report 1935), the area reserved for capitalists is rather more than for peasant grants; while the whole of the non-perennial area is reserved for peasant grants.

On the analogy of the Sutlej Valley project areas, it is proposed to divide up the good Crown waste areas as follows:—

Perennial areas:—

Reserved for capitalists	..	..	42,000 acres.
" " peasant grants	..	..	37,471 "

including an area of 6,071 acres at present given out on *Tahudkhahi* terms.

Non-perennial areas.

Total area = 21,777 acres, including an area of 541 acres, at present given out on *Tahudkhahi* terms.

The price of area reserved for capitalists is proposed to be Rs. 200 per acre.

For Crown waste areas given on peasant terms it is proposed to follow the same rates for *malikana* and purchase rights as are given in the Sutlej Valley Completion report, 1935, page 113 of Financial Forecast Statements.

* It has been decided by the Government that inferior perennial lands should be included in the forecast, vide note, dated 8th July 1935, by F. C. D. Page 108).

APP. E-I.

In addition to 37,471 acres of good land, an area of 31,995 acres of inferior land, requiring a preliminary crop of rice, would be available for being given out on peasant terms. In view of this area, the Financial Commissioner, Development, may agree to more area being reserved for capitalists, if required, to make the project productive.

Will Financial Commissioner, Development, please give his approval to the above figures being adopted for the preparation of the financial forecast.

A detailed list of all the Crown waste areas by districts which form the basis of the above figures is attached for ready reference of Financial Commissioner, Development. (see statements at the end of this Appendix).

J. D. H. BEDFORD.—18-6-1935,

Chief Engineer, Construction,

Irrigation Branch.

To S. S. F. C. D.

Note, dated the 6th July, 1935, by Mr. H. D. Bhanot, I.C.S., Senior Secretary to the Financial Commissioner, Development.

The main facts about the Crown waste area covered by the Haveli project as appearing from Chief Engineer, Construction's note, are :—

					Acres.
Good land	..	..	..	..	101,248
Inferior land	..	..	..	..	31,995
Bad land	..	..	..	..	86,303
Total	..	..	..	..	219,546

The soil survey was done either by the Agricultural Department or the Director of Irrigation Research. We have not the details of this soil survey, except the statements forwarded by the Chief Engineer. The Chief Engineer has the details and we may accept the figures as given in his note. The Chief Engineer proposes that for framing the financial forecast of the Haveli project, good land only should be taken into account. The details of good land are:—

					Acres.
Perennial	..	..	..	..	79,471
Non-perennial	..	..	..	..	21,777
Total	..	..	..	..	101,248

2. In framing a colonization scheme it is usual to deduct 10% from the total area for canals, main roads, and unculturable land, etc. See paragraph 2 of Mr. Macnabb's letter dated 22-1-1930,* containing the revised colonization scheme of Nili Bar colony. This deduction is made mainly for unculturable land. In the Haveli project we are dealing with only good land. I would, therefore, make a deduction of 5% from the total area available. This gives the following results:—

	Total area.		Gross area available for allotment after deducting 5%.
	Acres.		Acres.
Perennial	79,471	75,497
Non-perennial	21,777	20,689
Total	101,248	96,186

3. Further, in order to arrive at the net area to be sold or allotted as grants, a deduction is made for *abadi*, *charagah*, *lambardari* and *kamin* grants, water channels, village roads, etc. In auction *chaks*, reservation for *abadi*, *charagah*, *lambardari* and *kamin* grants, is not made, if the land sold consists of 200 acres or more. Paragraph 13 of Mr. Macnabb's letter,* referred to above, will show that a deduction of 5.3% was made in the area reserved for sale in Nili Bar colony. In the Haveli project the area reserved for sale is much smaller than the Nili Bar colony. The lots to be sold are likely to be small. I would, therefore, make a deduction of 6% from the area reserved for sale in order to arrive at the net area to be sold.

*Not printed.

APP. E-I.

For grants a deduction of 15% was made in Nili Bar colony, *vide* paragraph 13 of Mr. Macnabb's letter,* dated the 22nd January 1930. The soil survey statements forwarded by Chief Engineer will show that good and inferior land lies mixed up in Crown waste area. It will, therefore, be possible to utilize some inferior land for *abadis* and *chiragah*. In view of this, I would make a deduction of 10% from the area reserved for grants.

4. It is proposed that the entire non-perennial area should be allotted as peasant grants. This is what happened on the Sutlej Valley project and I agree with this. The result will be :—

	Acres.
Available for allotment, <i>vide</i> , paragraph 2 above	20,689
Deduct 10%, <i>vide</i> paragraph 3 above	2,069
Net available for allotment	18,620

5. For the perennial area (good land only) Chief Engineer's proposal is :—

	Acres.
For sale by auction to capitalists	42,000†
For allotment to grantees	37,471†
Total	79,471

This is based on the analogy of Nili Bar colony where out of 778,392 acres of perennial Crown waste land, 385,250 acres have been reserved for auction and 347,356 acres for grants.

6. The Nili Bar colonization scheme is :—

	Gross area.	Net area.
	acres.	acres.
For sale to capitalists	385,250	365,000
Land in exchange as compensation	23,000	20,000
Grants on peasant terms	347,356	302,049
Free grants or departmental reservations	19,086	18,958
Mandis and factories	3,700	3,700
Total	778,392	709,707

I believe there will be no departmental reservations in the Haveli project; but land will have to be given in exchange for land acquired for the project. In Nili Bar colony approximately 3% of gross Crown waste area has been reserved for this purpose. The same percentage may be adopted for the Haveli project, i.e., 2,265 out of 75,497 acres leaving 73,232 acres.

I think at least one *mandi* will be required in the Haveli project. In Nili Bar colony each *mandi* has been allotted approximately 1,000 acres. For Haveli project 800 acres will do leaving (73,232—800)=72,432 acres.

Chief Engineer says that 6,071 acres of perennial area are already held by *tahudkhahs*. These will presumably be converted into peasant grants as in the Nili Bar colony. To this area must, therefore, be added 10% for *abadis*, *chiragah*, *lambardari* and *kamin* grants, etc. Thus 6,678 acres will be required for *tahudkhahs* leaving (72,432—6,678)=65,754 acres.

In Nili Bar colony "grants on, peasant term" consist of military grants, police grants, *tahudkhahs*, Kitchen canal tenants, other locals and agricultural farm compensation. I have already taken into account the area held by *tahudkhahs*. I believe, there will be no military, police and agricultural farm grantees in the Haveli project; but there will be allotment to local peasant grantees and peasants from other districts. Therefore, we may safely reserve 34,000 acres for sale and the balance of 31,754 acres for peasant grants.

* Not printed.

† Page 105.

APP. E-I.

7. The colorization scheme for the good land of the Haveli project according to my proposals will be:—

	Gross area.	Deduction for general purposes.	Net area to be allotted.
	acres.	acres.	acres.
(1). <i>Perennial.</i>			
Sale by auction ..	31,000	2,040	31,960
Grants to peasants ..	31,754	3,175	28,579
Compensatory grants ..	2,265	227	2,038
<i>Tahudkhals</i> ..	6,678	607	6,071
<i>Mandis</i> ..	800	..	800
Total ..	75,497	6,049	69,448
(2). <i>Non-perennial.</i>			
Grants to peasants ..	20,689	2,069	18,620

The sale price of land to be auctioned at Rs. 200 per acre may be approved.

Malikana and purchase price for grants may be the same as in the Nili Bar colony.

8. In addition to the area detailed above, there is inferior land to the extent of:—

	acres.
Perennial ..	22,992
Non-perennial ..	9,003
Total ..	31,995

Chief Engineer says* that this inferior area will require a preliminary crop of rice. I think he is right in excluding it from the financial forecast; but the perennial area should certainly be tried on temporary cultivation. The perennial inferior area available for temporary cultivation will be:—

	acres.
Total area ..	22,992
Deduct 10% ..	2,229
Balance ..	20,693

I think this area, i. e., 20,693 acres, may be leased for temporary cultivation on an average rent of Rs. 3 per acre and it may be included in the forecast.

It is difficult to do anything with the non-perennial inferior area and it will be safest to exclude it from the forecast. It will probably be tried on temporary cultivation and its allotment can be considered if it improves.

H. D. BHANOT—6-7-35.

To F. C. D.

.. Senior Secretary, F. C. D.

Note, dated the 8th July, 1935, by Mr. B. H. Dobson, C.B.E., I.C.S., Financial Commissioner, Development.

This is only an estimate and Senior Secretary has compiled an admirable statement of the case with his experience of the Nili Bar.

His Excellency will no doubt at some subsequent date decide how Crown waste on the Haveli project is to be allotted. Hon'ble Member, Revenue might kindly ascertain whether he wishes to do so at the present stage. The project is however, under active preparation and Chief Engineer, Irrigation Branch, would like very early orders.

As to the contents of the above note, after discussion with Senior Secretary, I find myself in general agreement. I would, however, suggest the following amendments and additions—

- (1) Sale price of perennial land which it is proposed to auction, may be safely put at Rs. 250 instead of Rs. 200 per acre.
- (2) The purchase price for grantees, according to precedents, will be Rs. 100 in the case of perennial and Rs. 50 in the case of non-perennial land per acre.
- (3) *Malikana* varies from Rs. 2 to Rs. 3. We have not succeeded very well in recovering these charges. I would, put it at Rs. 2 in the case of perennial and Re. 1 in non-perennial areas, per acre allotted.

I have little doubt that we shall get Rs. 3 per acre for inferior perennial lands leased on temporary cultivation.

B. H. DOBSON—8-7-35.

F. C. D.

MUZAFFAR KHAN—15-7-35.

H. M. R.

H. W. EMERSON—16-7-35.

H. E.

(U. O. No. 263-C-(5), dated the 19th July 1935 from S. S. F. C. D.)

APPENDIX E-I, STATEMENT I

ABSTRACT OF RESULTS OF SOIL SURVEY OF THE CROWN WASTE LANDS IN THE HAVELI CANALS AREA.

Name of districts.	Fit for cultivation.	One preliminary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Total.
	Acres. <i>Left bank.</i>	Acres.	Acres.	Acres.	Acres.
Jhang	P. 11,861	3,713	2,323	..	17,897
Multan .. { P. †07,010 .. { N. P. †1,450* ..	60,060†	19,279	28,156	23,543	140,038
Total Left bank	80,921= N. P. 1,450 + P. 70,471	22,992	30,479	23,543	157,935
	<i>Right bank.</i>				
Jhang	15,792	6,358	8,466	3,092	33,708
Muzaffargarh	4,535‡	2,645	16,372	4,351	27,903
Total Right bank Non-perennial	20,327	9,003	24,838	7,443	61,611
Total both banks	101,248 N.P. 21,777 + P. 70,471	31,005	55,317	30,986	219,546

*Detail of 1,450 acres of area under non-perennial irrigation in Multan district is given in Statement III, Page III.

††Land requiring leaching are held as bad lands along with those, definitely unfit for cultivation. These have been excluded from all consideration. A reference in this connection is invited to Dr. Mackenzie Taylor's letter No. 794, dated 20-3-35, a copy of which is given on next page along with an abstract of the area soil-surveyed by him.

† P. denotes perennial.
N. P. denotes non-perennial.

‡This includes lands given on temporary cultivation and *tahudkhahi* terms, of which details are given below:—

		Acres.
Total Multan district ..	{ <i>Tahudkhahi</i> ..	6,530
	{ Temporary cultivation ..	1,751
Multan district non-perennial ..	{ <i>Tahudkhahi</i> ..	459
	{ Temporary cultivation ..	105
Multan district perennial ..	{ <i>Tahudkhahi</i> ..	6,071
	{ Temporary cultivation ..	1,646
Muzaffargarh district ..	{ <i>Tahudkhahi</i> ..	82
	{ Temporary cultivation ..	155

APPENDIX E-I, STATEMENT II
DETAILS OF SOIL SURVEY OF CERTAIN JUNGLES LYING SOUTH AND
NORTH OF THE RAVI RIVER

BY

The Director, Irrigation Research Institute, Punjab

Name of jungle.	CLASSIFICATION OF SOILS.				Total.	Remarks.
	Type I (low salt contents.)	Type II (one rice crop necessary).	Type III (alkaline and requires leaching).	Type IV (unsit for reclamation).		
1	2	3	4	5	6	7
SOUTH OF RAVI.	Acres.	Acres.	Acres.	Acres.	Acres.	
1. Mahr Shah and Maryala ..	327	3,061	2,331	0,628	17,217	
2. Kanhya Lal Wala ..	5,150	4,806	2,767	1,417	11,170	
3. Dhorn Sialanwala ..	4,737	3,415	4,255	2,048	11,455	
4. Kirpalgarh ..	1,073	..	1,253	847	4,113	
5. Rahimpur ..	1,418	..	..	..	1,418	
6. Jalwala ..	1,668	..	361	..	2,229	
Total ..	15,773	12,212	11,967	14,010	53,902	
NORTH OF RAVI.						
1. Bakh Kakkal Kohna	11,861	3,713	2,323	..	17,897	
2. Jungle Sahpur Bag	4,029	476	910	..	5,425	
3. Gagnala ..	11,656	4,765	12,604	4,255	31,580	
Total ..	27,546	8,954	17,167	4,255	57,902	
GRAND TOTAL ..	43,299	21,166	29,134	18,265	1,11,864	

*Vide letter No.
4079, dated the
18th December
1931, from
Mr. Mackenzie
Taylor.*

Copy of letter, No. 791, dated 20th March 1935, from Dr. E. Mackenzie Taylor, Director, Irrigation Research Institute, Punjab, to the Officer on Special Duty, Punjab Irrigation Secretariat, Lahore.

With reference to my report* on the soils of the Haveli project sent with this office No. 4079, dated 18th December 1931, in view of the work that has been done since this report was written, I would like to place on record a further opinion in order that my remarks on these soils may not be misunderstood.

The soils were divided by me into four types. Type I was given as suitable for direct cultivation. My opinion on this still holds good.

With regard to Type II, I stated that this was easily reclaimable and could be taken up directly by zemindars. Experience has now shown that while this type is easily reclaimable, it is unlikely to be reclaimed by zemindars unless land can be allotted to them, which is capable of direct cultivation at the same time, in an adjacent area, and unless concessions as regards water-rate and land revenue are also made.

My remarks to types III and IV hold good. Type III is unlikely to be reclaimed by a zemindar and type IV is not economically reclaimable.

2. For settlement purposes a much more detailed survey of the area will be required in order to determine how much of Type II can be allotted on the conditions mentioned above.

* Not printed ; results consolidated in the statement given above.

APPENDIX E-I, STATEMENT III

DETAILS OF SOIL SURVEY OF NON-PERENNIAL
CROWN WASTE JUNGLES IN THE MULTAN DISTRICT.

Name of rakh.	Fit for cultivation.	One prelimi- nary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Total.
	Acres.		Acres.	Acres.	Acres.
1. Kotla Mohd. Baqa ..	30	..	..	..	30
2. Khan Mohd. Wala ..	44	..	..	40	84
3. Taraf Jumma Khalsa ..	159	..	..	..	159
4. Jungle Bhera ..	..	..	..	1,019	1,019
5. Amirpur ..	106	..	..	..	106
6. Jaswantgarh ..	432	..	42	..	474
7. Kabirpur ..	43	..	..	..	43
8. Zainpur ..	80	..	..	14	94
9. Mir Hussain ..	271	..	418	..	689
10. Shahpur Ubba ..	100	..	..	130	230
11. Dairapur ..	126	..	..	..	126
12. Boapur ..	53	..	..	..	53
Total ..	1,450	..	460	1,203	3,113

APPENDIX E-1, STATEMENT IV

DETAILS OF SOIL SURVEY OF CROWN WASTE JUNGLES IN THE MULTAN DISTRICT
BY THE DEPARTMENT OF AGRICULTURE, PUNJAB.

Serial No.	Name of Rakh.	According to Soil Survey.				According to Civil Records.			Total.
		Fit for cultivation.	One preliminary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Crown waste.	On temporary lease.	On Tehadkhast terms.	
		Acres 317	Acres 3,001	Acres 3,331	Acres 9,028	Acres 16,890	Acres ..	Acres 347	Acres 17,237
1	Maryala Meht Shah*	..	..	..	61	15	11	68	97
2	Khaggenala	..	..	..	51	51	..	..	51
3	Tatipur	..	..	..	..	355	..	..	355
4	Rakh Arbi	..	..	..	..	550	..	..	550
5	Sher Singh Wala	..	..	..	..	..	10	26	36
6	Kotla Mohd. Baqa	..	..	..	..	13	..	..	13
7	Lashkarpur	..	..	..	..	..	1	110	120
8	Piran Ghalib	..	..	..	40	..	48	36	81
9	Khon Mohd. Wala	..	..	..	..	..	..	159	159
10	Taraf Jummah Khalsa	..	..	..	..	..	..	..	..
11	Jungle Bhicia	..	..	..	1,016	942	52	25	1,019
12	Chadhar	..	..	..	102	..	67	185	252
13	Jungle Nurwal, Shumali	..	..	..	128	125	..	53	178
14	Yaru Wala	..	..	..	..	27	02	231	350
15	Amirpur	..	..	..	..	..	..	106	106
16	Mullan Ilyas	..	..	..	..	1,007	26	280	1,315
17	Rahimpur*	..	..	..	..	1,205	102	111	1,418
18	Faizpur	..	..	..	..	402	..	47	449
19	Rangilwala	..	..	..	..	150	146	..	310
20	Araf Wala	..	..	..	..	106	116	87	332
21	Chhinne Wala	..	..	..	..	1,000	7,168	..	7,168
22	Kotla Rahim Ali	..	..	..	..	..	55	..	52
23	Jungle Dhora Sialan Wala*	..	..	..	2,000	1,000	7,168	..	107
24	Kanaya Lal Wala*	..	..	..	..	..	..	..	..
25	Billi Wala	..	..	..	..	..	..	..	..
26	Jaswant Garh	..	..	..	..	..	..	..	..
27	Rid	..	..	..	..	..	..	..	..
28	Bhakal Bir	..	..	..	..	..	..	..	..
29	Kabirpur	..	..	..	..	..	..	..	..
30	Zaidpur	..	..	..	..	..	..	..	..
31	Kirpal Garh*	..	..	..	..	..	..	..	..
32	Kalaranwala	..	..	..	..	..	..	..	..
33	Jalwala*	..	..	..	..	..	..	..	..
34	Mir Hussain	..	..	..	..	..	..	..	..
35	Shah Pur Uhla	..	..	..	..	..	..	..	..
36	Daira Pur	..	..	..	..	..	..	..	..
37	Wahi Raja Rani	..	..	..	..	..	..	..	..
38	Jungle Ghang Wala*	..	..	..	..	..	..	..	..
39	Saidpur Baggi*	..	..	..	..	..	..	..	..
Carried Over		41,487	18,785	28,156	21,713	104,408	1,120	4,613	1,10,141

* These jungles were resurveyed in more detail by the Director, Irrigation Research Institute, Punjab, see Statement II.

APPENDIX E-I, STATEMENT IV—concluded.

Serial No.	Name of <i>Rakh</i> .	According to Soil Survey.				According to Civil Records.			Total.
		Fit for cultivation.	One preliminary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Crown waste.	On temporary lease.	On <i>Tahudkhahi</i> terms.	
	Brought forward ..	acres 41,478	acres 18,785	acres 28,156	acres 21,713	acres 101,408	acres 1,120	acres 4,613	acres 110,141
40	Rakh Makhdom Venoi ..	24,914	..	..	..	24,914	..	..	24,914
41	Abdul Hakim ..	200	494	..	..	675	..	119	694
42	Arjani Wala ..	149	..	..	..	..	11	138	149
43	Makhdom Pur Pahra ..	..	..	..	..	235	..	..	235
44	Bhero Wal ..	1	..	..	..	..	..	1	1
45	Jiwand Singh ..	87	..	..	..	..	..	87	87
46	Faridpur ..	13	..	..	..	..	..	13	13
47	Chak Sultan Mohammad ..	81	..	..	..	..	..	81	81
48	Rukan Wala ..	97	..	..	..	..	..	97	97
49	Rasul Pur ..	1	..	..	..	..	..	1	1
50	Nihale Wala ..	73	..	..	..	..	..	73	73
51	Toru ..	71	..	..	..	..	..	71	71
52	Dewa Singh Wala ..	408	..	..	..	..	..	408	408
53	Sandhian Wali ..	11	..	..	..	..	..	11	11
54	Hosi ..	12	..	..	..	12	..	12	24
55	Aulok Sandhu ..	112	The jungles (items 42—77) were not soil-surveyed. Land at present given on temporary lease and <i>Tahudkhahi</i> terms only is assumed, to be fit for cultivation, to be on the safer side. The balance of land considered unfit for cultivation is 1,830 acres.				..	112	112
56	Baqar Pur ..	70					..	40	70
57	Kuksanabad ..	35					..	..	35
58	Kot Gauhar Mohammad ..	43					..	..	43
59	Shahadat Kaudale ..	34					50	12	81
60	Manra Mughlani ..	19					7	4	26
61	Sultan Hiraj ..	82					..	77	82
62	Haveli Diwan Singh ..	16					..	7	16
63	Sasrana ..	3					..	3	3
64	Shalas Kotwala ..	1					..	1	1
65	Tareli ..	13					2	13	15
66	Sai Sahu ..	1-5					..	1-5	1-5
67	Daira Mahram ..	3					3	3	6
68	Jalil Pur ..	56					..	56	56
69	Sheikhupura ..	53					255	53	308
70	Jungle Disti Maluk ..	475					563	218	1,038
71	Akramabad ..	8					7	8	15
72	Jungle Nuewala Janubi ..	311					683	123	1,024
73	Dumra ..	3					..	3	3
74	Sujanpur ..	0-5					3-5	..	4
75	Kirpalgarh ..	0-25					4-75	..	5
76	Khairabad ..	2-5					5	..	7-5
77	Buapur ..	53	..	..	1,830	..	..	53	53
	Grand Total ..	69,060	19,279	28,156	21,513	131,767	1,761	6,530	140,138

APPENDIX E-I, STATEMENT V

DETAILS OF SOIL SURVEY OF THE JUNGLES IN THE JHANG DISTRICT BY THE
DEPARTMENT OF AGRICULTURE, PUNJAB

Serial No.	Name of Rakh.	Fit for cultivation.	One preliminary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Total.
		acres	acres	acres	acres	acres
1	<i>Left Bank.</i>					
	Kakkal Kohla*	11,561	3,713	2,323	..	17,597
	Total Left Bank	11,561	3,713	2,323	..	17,597
	<i>Right Bank.</i>					
2	Jhok Dargahi Shah .. ..	..	..	250	250	500
3	Jai Wahan	682	..	345	..	1,027
4	Jagan	130	158	..	160	398
5	Vijla	915	800	800	700	3,345
6	Sialkot	977	..	..	..	977
7	Mahmudkot	392	..	..	..	392
8	Gari Maharaja .. ..	..	1,200	..	263	1,463
9	Dul	200	..	100	50	350
10	Shah Yusaf	1,150	..	608	600	2,448
11	Rakh Pir Abdul Rahman	610	300	..	..	910
12	Akmalpur	8,051	1,000	6,000	200	15,251
13	Kapuri .. ..	..	300	201	..	501
14	Kundal Khodcharan	2,612	2,500	..	900	6,012
	Total Right Bank	16,792	6,358	8,406	3,092	33,708
	Grand Total Right and Left Banks	27,653	10,071	10,789	3,092	51,605

N. B.—Rakh Kotla excluded, being uncommanded.

* This jungle was resurveyed in more detail by the Director, Irrigation Research Institute, Punjab, see Statement II.

APPENDIX E-I, STATEMENT VI

DETAILS OF SOIL SURVEY OF THE JUNGLES IN THE MUZAFFARGARH DISTRICT

Serial No.	Name of Rakh.	According to Soil Survey.				According to Civil Records.			Total.
		Fit for cultivation.	One preliminary rice crop necessary.	Alkaline requiring leaching.	Unfit for reclamation.	Crown waste.	On temporary lease.	On <i>Zabudkhahi</i> terms.	
		acres	acres	acres	acres	acres	acres	acres	acres
1	Makhan Bela	822	..	..	120	912	..	..	942
2	Jalwala	800	..	223	..	1,023	..	..	1,023
3	Alipur Jamahi .. ..	..	..	1,180	..	1,186	..	..	1,186
4	Sarvani Bela	127	..	1,108	..	1,363	..	..	1,363
5	Khandai .. ..	..	..	12,342	200	2,642	..	..	2,642
6	Jhalarian	650	415	700	300	1,065	..	..	1,995
7	Chitwahan .. ..	..	..	367	120	477	..	..	477
8	Harpallo .. ..	..	..	400	..	400	..	..	400
9	Jogewala .. ..	..	..	609	200	809	..	..	809
10	Dera Wadhu	288	..	..	..	288	..	..	288
11	Sadi Wahi .. ..	..	..	666	..	666	..	..	666
12	Dera Habi .. ..	..	..	1,223	..	1,223	..	..	1,223
13	Kotla Sandat .. ..	..	..	..	560	560	..	..	560
14	Kanail Sandila	300	..	108	..	408	..	..	408
15	Kandiwal	1,500	2,200	4,000	1,449	9,149	..	..	9,149
16	Khanpur .. ..	..	..	3,300	1,402	4,465	155	82	4,702
	Total	4,635	2,615	16,372	4,361	27,666	155	82	27,963

APPENDIX E-II

COMPOSITE LAND REVENUE AND WATER-RATES IN THE HAVELI CANALS AREA.

Note, dated the 1st April 1935, by His Excellency, Sir Herbert William Emerson, K.C.S.I., C.I.E., C.B.E., I.O.S., the Governor of the Punjab.

1. At the conference held on Saturday, the 23rd of March, the question was discussed of revised estimates for the Haveli project and I promised to write a note on the subject. Revised expenditure and revenue estimates will have to be prepared, and I deal with these separately.

Expenditure Estimates.

2. The following points should receive attention in preparing the expenditure estimates :—

(a) Whether an alternative alignment of the right bank canal is possible, in order to avoid the Thal tract; and how the danger of severance by the river can be met if an alternative alignment is adopted?

(b) As regards labour rates, estimates should be compared with rates now in force.

(c) As regards the cost of railway stock and plant and tools generally, account should be taken of the utilisation of materials available from the Sutlej Valley project.

(d) The estimates for the acquisition of land should be further checked.

(e) Interest charges on capital should be revised in consultation with the Finance Department.

Preparation of the Revenue Estimates.

3. The first thing to do will be to review the figures for area, having regard to the improved water supply that is now contemplated. For instance, in paragraph 23 of Mr. Smith's note, dated the 10th of March 1932, (see Haveli project 1932) the assumption was made that, on the supply then proposed, 65% of the cultivable area on the Sidhni would be matured. It may be reasonable to increase this figure.

4. Again, on the non-perennial canals, the fact that water will be given normally for *rabi* sowings up to the 31st of October, ought to mean a substantial increase in sown areas for the *rabi* as compared with present conditions. Similarly, the fact that water will be received for early *kharif* sowings, ought materially to increase the *kharif* area.

5. One way of approaching the subject for the Sidhni and non-perennial areas separately, will be to take average areas under the present system, and add reasonable increases for improved conditions.

6. In order to estimate the revenue from water-rates, it will be necessary both on the Sidhni and on non-perennial areas separately, to consider for (i) *kharif* and (ii) *rabi*, what the percentages of cropping under different crops are likely to be. For instance, one would expect, first, that a larger total area will be placed under *kharif* on both systems, and, second, that cotton will represent a much higher percentage of the cropping than at present. What has happened in favourable years in the past, will be some index to what is likely to happen in normal years in the future.

7. In calculating the new revenue, it will be necessary to take into account :—

(a) new Crown lands brought under cultivation;

(b) the return from land revenue rates; and

(c) the return from water-rates.

As regards (a), the ordinary procedure will be followed.

As regards (b), it is necessary to distinguish between—

(i) the Sidhni and areas which will receive the same irrigation; and

(ii) the non-perennial canals.

So far as the Sidhni is concerned, the following assumptions may be made :—

(1) The land revenue rates on non-canal irrigated matured areas will remain as at present.

(2) The fixed well assessment will remain as at present.

(3) The consolidated rate will be split up into land revenue rates proper and water-rates. So far as land revenue rates are concerned, no distinction will be made between different classes of crops, and no distinction will be made between the Sidhni proper and the three subsidiary canals, the Fazil Shah, Abdul Hakim and Kuranga. The new system of land revenue

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assessment will be the imposition on *nahri* and *chahi-nahri* matured areas of a flat rate, which, for present purposes, may be taken at Rs. 2-8-0 per acre matured.

For the non-perennial canals, the following assumptions can be made:—namely, that both the fluctuating land revenue rates and the fixed well assessment will remain as at present. Further, so far as fluctuating rates are concerned, these will be applied, as a matter of course, to new proprietary areas brought under cultivation.

8. It will be observed that the assumption is made that the fixed well assessment will remain unchanged. The reason for this is that the orders of Government on the Final Assessment Report of the Multan district makes it clear that the fixed assessment on wells was guaranteed for a period of 30 years. We can, therefore, only change these with the agreement of the people. I do not think that, in any case, any change will be desirable on the non-perennial canals. A change may, however, be desirable on the Sidhuni, and the people may wish for the change. In that case, it may be practicable to allow each land owner to decide once and for all, whether (a) he will keep the well assessment, or (b) he will pay fluctuating rates on *chahi* and *chahi-nahri* as follows:—

<i>Chahi</i> per acre matured	Rs. 1-12-0
<i>Chahi-nahri</i> per acre matured	Rs. 0-12-0

The *Chahi-nahri* rate would be in addition to the Rs. 2-8-0 already mentioned. This is a matter, however, for future consideration, which does not affect the revenue estimates.

9. The next step will be to propose water-rates—

- (a) for the Sidhuni and similar areas;
- (b) for the non-perennial canals.

In proposing water-rates for the Sidhuni, three factors will have to be taken into account:—

- First*—Appropriate rates, having regard to those in force on similar canals;
- Second*—The undesirability of making too sharp and sudden an increase on present rates in the Sidhuni, which include both the land revenue and water-rates; and
- Third*—The fact that, in the *rabi* it will still be necessary to use wells to a considerable extent.

On the non-perennial canals, the existing rates on similar canals elsewhere will be a guide, and also the existing rates on the inundation canals. It has to be remembered that, on the non-perennial canals, the only increase Government can take, will be in the form of water-rates, since the land revenue rates must remain unaltered.

10. The calculations must be detailed both for the Sidhuni and non-perennial canals. That is to say, they must show the matured areas which have been assumed; the distribution of these areas between the various crops; and the resulting revenue from land revenue and water-rates.

11. As regards canals on the right bank, the same method should be followed as for canals on the left bank. Further, throughout the calculation, no assumption should be made that Government is carrying this project out, in order to compensate for any losses that may have resulted from the Triple project. The estimates must be made on their merits, having regard to the conditions which the project will create, and the rates which it is reasonable for Government to charge.

12. In addition to the direct credit to the project represented by the above items, account must be taken of the indirect credit to the project which will result from water at Balloki being made available for other use. For instance, if that water is used partly for making the Burala Extension perennial, then the resulting net increase in revenue should be credited to this project. If water will still be available after providing for the Burala Extension, then proposals should be made for its further use, and credit taken for that use.

H. W. EMERSON—1-1-1935.

H. E.

Note, dated the 2nd July 1935, on composite land revenue and water-rates for the Haveli canals area by Mr. Kanwar Sain, I.S.E., Executive Engineer on Special Duty.

1. *Existing land revenue and water-rates.*

Statement I* of this Appendix shows the land revenue and water-rates both on the Sidhnai and the inundation canals in the Multan district. On the Sidhnai canal the land revenue and the water-rate is a combined charge and it is usual to take half of it as land revenue and half as water charges. This is supported by Appendix II, page 3, Final Settlement Report, Multan district, 1921.

2. *Proposals regarding water rates.*

Statement II† gives in a convenient form the water-rates on the Sutlej Valley perennial and non-perennial areas, on the Sidhnai and its subsidiary canals, and on the Chenab Left and Right Bank Inundation canals.

There is much to be said for the argument that the perennial and non-perennial canals on the proposed Haveli should not be assessed at lower rates than are in force at present on the Sutlej Valley canals. If this view is to prevail then the rates given in columns 2 and 3 may be accepted for the project, but if on the other hand it is considered that there is a limit to which existing rates can be raised, alternative rates are proposed in columns 7 and 8.

3. The water supply in the Haveli perennial and non-perennial areas during summer will be very favourable as shown in column 7 (a) of Statement IV‡ and columns 6, 7, 11 and 12 of Statement VI§ of Appendix D-I, hence as far as purely summer crops are concerned there seems to be no reason why there should be any difference in rates in the perennial and non-perennial areas. The non-perennial rate of sugarcane is proposed to be Rs. 1 less than perennial because sugarcane requires some waterings in winter also. The rate for wheat in the perennial area is suggested at Rs. 3-8-0, which is appreciably lower than what is being paid at present on the Sutlej Valley perennial area. It should be lower in view of our desire to keep the wells working, and this applies to all the winter crops. At present the water-rate for rice on the Sutlej Valley canals is higher than cotton, though rice is not so profitable a crop to grow. The result is that the cultivation of rice on the Sutlej Valley is decreasing.

Schedule of rates proposed in columns 7|| and 8|| is probably more logical than that in force at present in the Sutlej Valley area and as there are large numbers of crops of the same rate, they will be easier to operate. In winter on the Haveli non-perennials, the rates proposed are the same as existing at present on the Sutlej Valley non-perennials; all winter crops Rs. 2-4-0, fodder Rs. 2. The non-perennials will get a supply right up to the end of October and they will be definitely better off than the Sutlej Valley non-perennials paying the same rate.

4. *Probable percentage of various crops.*

Statement III¶ shows the various percentages of the principal summer and winter crops in certain assessment circles of the Multan district and on the Wali Mohammad, Sikandarabad, Ganesh, Taliri, Karam and Sidhnai canals separately; and also in the Jhang and Khanewal divisions. The percentages in the Jhang and Khanewal divisions provide a guide as to what may possibly be expected on the Haveli perennial area when the supply is increased and stabilised. The percentages on the Sikandarabad and Sidhnai (Statements IV & V)** in favourable years serve as an index as to what is likely to happen in normal years in the non-perennial area after the construction of the Haveli project. In the Jhang division, the cotton percentage on total summer crops is 47 and in the Khanewal division it is 58. Columns 11 and 12 of Statement III show the proposed percentages for the Haveli project area. The percentages of the expensive crops proposed are not unduly high as compared with columns 9 and 10. This is important, as a high percentage of expensive crops will give us a high composite water-rate and the object of this enquiry is to arrive at a moderate forecast of the probable financial returns.

5. *Composite Water-rates.*

The flow rates for the various crops in columns 13, 15, 17 and 19 of Statement III¶ are taken from columns 2, 3, 7 and 8 of Statement II† respectively. Columns 14, 16, 18 and 20 of Statement III‡ give the composite water-rates on the various percentages of crops proposed in columns 11 and 12. In a separate note, it has been shown that with the water available we will get a cropping ratio for summer and winter crops of 1 to 1.33. The bottom of columns 14, 16, 18 and 20 shows the composite yearly water-rate per acre proposed for the Haveli perennial and non-perennial, based on the Sutlej Valley rates and the lower schedule as proposed in columns 7 and 8 of Statement II†. An example is given below to show how the calculations have been made:—

Consider columns 11, 13 and 14 of Statement III¶—

Cotton	45% of Rs. 5-4-0	.. =	37.8 annas.
Rice	2% of „ 6-8-0	.. =	2.1 „
Sugarcane	5% of „ 11-0-0	.. =	8.8 „
Other summer crops	18% of „ 5-0-0	.. =	14.4 „
Fodder	30% of „ 2-8-0	.. =	12.0 „

Composite *Kharif* rate .. = 75.1 annas = Rs. 4-11-0

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Wheat ..	65% of Rs. 4-4-0	= 44.2	Annas
Other winter crops ..	25% of „ 4-0-0	= 16.0	„
Fodder ..	10% of „ 2-8-0	= 4.0	„

Composite rabi rate 64.2
= Rs. 4. „

Ratio of summer to winter crops 1 to 1.33.

Water-rate for summer crops = Rs. 4-11-0

Water-rate for winter crops 1.33×4 = Rs. 5-5-0

Total = Rs. 10-0-0

Hence composite rate for the year = $\frac{10}{2.33} = \text{Rs. } 4-4-0$; and so on for the other rates.

6. Land revenue rates for the perennial areas.

In accordance with His Excellency's instructions, the proposed rate for land revenue in the perennial tract has been taken as Rs. 2-8-0 per acre which represents a small increase on the existing rate.

The statement given below shows the significance of the proposals as applied to the Silluani Assessment Circle of the Multan tehsil:—

EXISTING SILLUANI AREA PERENNIAL				PROPOSALS FOR HAVELI PERENNIAL					
Rates for class I.				Water-rates at lower schedule.			Water-rates as on S. V. P.		
	Land revenue.	Water-rate.	Total.	Land revenue.	Water-rate at lower schedule.	Total land revenue and water-rate.	Land revenue.	Water-rate based on Sutlej Valley figures.	Total land revenue and water-rate.
1	2	3	4	5	6	7	8	9	10
	Rs. As.	Rs. As.	Rs. As.	Rs. As.	Rs. As.	Rs. As.	Rs. As.	Rs. As.	Rs. As.
Chahi ..	1 10	..	1 10	1 10	..	1 10	1 10	..	1 10
Chahi-nahri ..	2 1	2 1	4 13	2 8	3 12	6 4	2 8	4 4	6 12
Nahri ..	2 1	2 1	4 2	2 8	3 12	6 4	2 8	4 4	6 12

*Actually a fixed lump sum rate per well is charged. The average rate per well in this circle is Rs. 17 and this is supposed to have been based on 0-11-0 per acre, which explains the item of 0-11-0 under land revenue for *chahi-nahri*. When water supplies were short as in the past the anomaly of charging more for *chahi-nahri* (i.e., Rs. 4-13-0) than for *nahri* (Rs. 4-2-0) was not of much importance, but in the future, when we desire to keep the wells working, it may be necessary to abandon the fixed assessment on wells, and if the people are agreeable to convert the fixed well assessment into a fluctuating assessment of Rs. 1-10-0 per acre for *chahi*. It is suggested that no *chahi-nahri* charge be made additional to the proposed *nahri* land revenue and water-rates, which for perennial areas is Rs. 6-4-0 based on columns 7 and 8 of statement II* or Rs. 6-12-0 according to Sutlej Valley project schedule of water-rates.

A consolidated rate of Rs. 6-4-0 attained above compares with the present consolidated rate of Rs. 4-2-0 to 4-13-0. The increase is less than 50% and is moderate.

7. Land revenue rates for the non-perennial areas.

In the non-perennial area, in accordance with His Excellency's instructions, there is to be no change in land revenue rates and, as per Statement III†, columns 16 and 20, the composite water-rate proposed, comes to Rs. 3-3-0 or Rs. 3-1-0 according as the Sutlej Valley project schedule is accepted or not.

8. The figures of probable irrigation according to percentages given in Appendix D-I, Statement VIII‡, and the resulting land revenue at the existing fluctuating land revenue rates have been calculated for each Assessment circle for the area covered by the Haveli project. From these figures we get a composite rate for land revenue, vide Statement VI¶ attached to this Appendix. This composite rate will be added to the water-rates given above for purposes of arriving at the full land revenue and water-rates to be obtained from the total non-perennial irrigation.

KANWAR SAIN—2-7-35,

Executive Engineer on Special Duty.

Forwarded to the Financial Commissioner, Development, for approval of the composite rates given in the above note.

J. D. H. BEDFORD—2-7-35,

Chief Engineer.

Note, dated the 26th July 1935, by Mr. Ihsan Ullah, Revenue Officer
on Special Duty.

Statement No. I*.

I have no criticism to offer in regard to statement No. I* referred to in para. I of the foregoing note. This statement merely gives the land revenue and water-rate charges at present obtaining in the three tahsils—Kabirwala, Multan and Shujabad—of the Multan district, proposed to be served by the Haveli project. Under the heading 'fixed land revenue,' no mention has been made of the 'date assessment' (meaning fixed assessment on date palms), nor was, I think, any need for it, as also for the lump-sum assessment on the wells, as given in the statement, because the date assessment and lump-sum well assessment will remain as at present.

Statement No. II†.

Statement No. II† gives the existing water-rates on the Sutlej Valley project, perennial and non-perennial, and on the Sidhnai and other inundation canals both on the left and the right banks and those proposed for perennial and non-perennial areas likely to fall within the Haveli project.

The view of the Irrigation Department seems to be that the Sutlej Valley project rates—both perennial and non-perennial should be levied in the Haveli project. At the same time, they have proposed alternative rates, under both systems, as shown in columns 7 and 8 of the statement.

A close study of the statement discloses that the rates now proposed are in most cases lower than those obtaining in the Sutlej Valley project, but certainly much higher than those on the existing Sidhnai and other Chenab Inundation canals.

So far as the Sutlej Valley project rates go, there is, I think, little prospect of the people accepting anything like these rates. Those rates were fixed at the time of high prices which are not likely to occur.

The proposed rates are not unduly high and should be, with slight modifications, acceptable to the rate-payers. In regard to these rates, however, I would like to make a few observations.

2. In the case of rice under both systems—perennial and non-perennial—the water-rate has been fixed at Rs. 5-4-0 per acre. In the Multan district, where the soil is admittedly better than Jhang and Muzaffargarh districts, the maximum outturn assumed at settlement for this crop, in the best Uttar circle of Multan tahsil, was 12 mds. per acre and in the Hithar circle of all the tahsils, in the district, except Lodhran, it was 5½ mds. A rough outturn of 10 mds. per acre will, I think, not err on the side of leniency and may be assumed in the present enquiry. The average price per maund is in the neighbourhood of Rs. 1-4-0 and the value of an acre's yield may be put at Rs. 12-8-0. *Batai* will be one-half. Land revenue and water charges, exclusive of cesses, on the perennial system comes to Rs. 7-12-0. Working expenses and *Kamin* dues have also to be taken into consideration. Some reduction is, therefore, necessary. I propose a rate of Rs. 4-12-0 for this crop.

3. The rate for cotton on the Sutlej Valley project is Rs. 5-4-0 per acre and the same has been proposed here under both systems. Sometimes American cotton requires watering even after 15th October. On the non-perennial system it will still be necessary to use wells for full maturity. In all other *khari* crops lower rate than Sutlej Valley project has been proposed. In my opinion the charge should be less in the case of cotton also, and I think Rs. 5 would do.

In the case of melons a rate of Rs. 5-4-0 under both systems has been proposed as against Rs. 5 on the Sutlej Valley project. Although the crop is insignificant, yet the difference is evident. I would like to put it at Rs. 4-12-0.

4. Likewise in the case of *bajra*, gram and pulses the proposed rate on the perennial is Rs. 3-8-0 as against Rs. 3-4-0 on the Sutlej Valley project. These crops occupy a fairly high percentage of the cropping and the rate should be equal to, if not less than, the Sutlej Valley project rates. I propose Rs. 3-4-0.

5. A rate of Rs. 4 per acre has been proposed for maize, which is even higher than that proposed for wheat. It is not a very paying commodity. Some of it is used as fodder and whatever is left behind for maturity does not fetch a higher price than gram, *bajra* and pulses, for which a lower rate has been proposed. To me there seems no point in differentiating this commodity from gram, *bajra* and pulses in the matter of fixation of water-rate. I would propose the same rate, i.e., Rs. 3-4-0 for maize also.

6. There is yet another aspect of the case which, I think, deserves serious consideration. It is this, whether Government can legally force the rate-payers to accept the water-rates they propose to levy? Under the existing circumstances any enhancement can, I think, be effected with the consent of the tax-payers. If the former view prevails, then the rates now proposed may be adopted with the alterations now suggested. If the latter view is correct, then necessary action should be taken to get the statements of the zamindars concerned.

* Page 135.

† Page 136.

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7. In para 9* of the note, dated the 1st April 1925, regarding the preparation of revenue forecast of the Haveli project, His Excellency has expressed the undesirability of making too sharp and sudden an increase on the present rates on the Sidhnai. The increase now proposed is material, though not inequitable. But to avoid difficulties, it may, perhaps, be advisable to charge the existing rates plus half of the proposed rates for the first 5 years, after which the full proposed rates can come into play. This seems necessary in view of (a) His Excellency's instructions referred to above, and (b) that things will have hardly stabilised by that time. If the water supply is favourable, as it should be according to the reports of the Irrigation Department, the rate-payers will not, I think, raise any objection to the payment of the water-rate charges as now proposed. Or, as another alternative, full water-rates now being proposed be levied and a special remission on each harvest up to the extent of 50 per cent. of the additional rates, according to the condition of crops, be granted for a term of 5 years from the date of commencement of new irrigation. Thereafter full rates be charged.

8. The following percentages of principal crops have been proposed by the Irrigation Department :—

Kharif.			Rabi.		
Name of crop.	Perennial.	Non-perennial.	Name of crop.	Perennial.	Non-perennial.
Cotton ..	45	35	Wheat ..	65	65
Rice ..	2	10	Other rabi crops ..	25	20
Sugarcane ..	5	2	Fodder ..	10	15
Other kharif crops ..	18	18			
Fodder ..	20	35			
Total ..	100	100	Total ..	100	100

The ratio of *kharif* to *rabi* has been proposed as 1 : 1.33=43 to 57 per cent.

A comparison of these figures with those worked out from the revenue record will perhaps, be helpful in arriving at a correct conclusion. The table below gives the percentages of principal crops, based on the average of 4 years, in the areas, at present receiving Sidhnai irrigation, in the Multan tahsil. This will serve as a guide as to what is likely to happen under stabilised conditions of water supply.

Kharif.			Rabi.		
Name of crop.	Percentage.		Name of crop.	Percentage.	
	Existing.	Proposed.		Existing.	Proposed.
Sugarcane ..	3	7	Wheat ..	65	65
Rice ..	7	4	Toria sathri (oil .. seeds)	5	5
Cotton ..	41	45	Fodder ..	10	10
Maize, jawar, bajra ..	7	6	Other rabi crops ..	14	20
Fodder ..	26	20			
Other kharif crops ..	16	18			
Total ..	100	100	Total ..	100	100

The ratio of *kharif* to *rabi* is 43 to 57%.

Considered from every point of view this is the best tract of the Multan tahsil and compares very favourably with the area now receiving Sidhnai irrigation in the Kabirwa

*Page 116.

† This ratio results from the water that is available on the average in the *kharif* and *rabi* as shown detail in Appendix. D-I.

KANWAR SAR
E.E. Haveli (I.I)

tahsil. In my opinion, one can expect but slight changes under the proposed scheme. There is, however, some room for the remunerative crops, like cotton and sugarcane, to take the place of unproductive crops. It is only the remunerative crops on which the zemindars can, and, I think, do rely to defray their expenses. Rice does not pay much to the farmer and is bound to go down under the changing conditions. Similarly some of the other *kharif* crops, i.e., maize, *jowar* and *bajra* are mostly used as fodder and it is futile to expect that cotton will occupy the same percentage. An increase is evident. Likewise some of wheat and other *rabi* crops, i.e., gram, barley to some extent and *chani*, as a whole, are used as fodder and there is no doubt that there will be some decrease under the heading "fodder." In these circumstances, I have proposed the percentages of the principal crops, as shown in the table above, under the heading 'proposed' in respect of the perennial areas.

It will, therefore, appear that I have suggested no amendments in the figures of Irrigation Department in respect of *rabi* and they may be sanctioned. As to the *kharif* percentages, the alterations proposed are, in my opinion, necessary. The ratio of *kharif* to *rabi* is exactly the same as proposed by the Irrigation Department and may be accepted.

9. As to the non-perennial areas the Uttar Circle of the Multan tahsil will, perhaps, serve as a better criterion in regard to the future state of affairs in the matter of cropping. The table below gives the existing and proposed percentages of the principal crops. In assuming the proposed figures due regard has been paid to the undoubted fact that even in *kharif* it will be necessary to use wells up to the closure of the canals, till the full maturity of the sugarcane and cotton, and that wells will be constantly in use during the whole *rabi* harvest.

<i>Kharif.</i>			<i>Rabi.</i>		
Name of crop.	Percentage.		Name of crop.	Percentage.	
	Existing.	Proposed.		Existing	Proposed.
Sugarcane ..	2	4	Wheat ..	65	65
Rice ..	11	10	<i>Toria sa'hri</i> (Oil-seeds)	2	2
Cotton ..	31	35	Fodder ..	22	15
Maize, <i>jowar</i> , <i>bajra</i> ..	9	6	Other <i>rabi</i> crops ..	11	18
Other <i>kharif</i> crops ..	9	15			
Fodder ..	38	30			
Total ..	100	100	Total ..	100	100

The ratio of *kharif* to *rabi* is 45 per cent. to 55 per cent.

It will be seen that again my figures and those worked out by the Canal Department tally in respect of *rabi*, while I have suggested certain alterations in respect of *kharif* which may be sanctioned.

The ratio of *kharif* to *rabi*, i.e., 50 per cent. to 50 per cent. as proposed by the Irrigation Department, may be approved.

10. With the slight amendments in *adiana* rates and the percentages of the cropping which I have proposed, the composite rate as worked out by the Irrigation Department may also be slightly changed.

This is explained below :—

PERENNIAL.

<i>Kharif.</i>	annas.
Cotton, 45% of Rs. 5	= 36
Rice 4% of Rs. 4-12-0	= 3
Sugarcane, 7% of Rs. 7	= 7-8
Maize, <i>jowar</i> , <i>bajra</i> , 6% of Rs. 3-4-0	= 3-1
Fodder, 20% of Rs. 2-1-0	= 6-6
Other <i>kharif</i> crops, 18% of Rs. 5	= 14-4
Composite <i>kharif</i> rate	= 70-9 = Rs. 4-6-0

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Rabi.

	annas.
Wheat, 65 of Rs. 3-8-0	= 36.4
Toria and sathri 5% of Rs. 3-8-0	= 2.8
Fodder 10% of Rs. 2/1	= 3.3
Other rabi crops, 20% of Rs. 3-8-0	= 11.2

Total = 53.7 = Rs. 3-5-0

Ratio <i>kharif</i> to <i>rabi</i>	= 1 : 1.33 = 43% to 57%
<i>Kharif</i> <i>abiana</i>	= Rs. 4-6-0
<i>Rabi</i> <i>abiana</i>	= 1.33 × Rs. 3-5 = Rs. 4-6-0
Total	Rs. 4-6-0 + 4-6-0 = Rs. 8-12-0

Mean composite rate for the year = Rs. $\frac{8.12}{2.33}$ = Rs. 3-12-0

According to the instructions given in para. 7 (b) (i) (3)* of His Excellency's note, dated the 1st April 1935, a flat-rate of Rs. 2-8-0 per acre irrespective of crops has to be imposed on the areas proposed to be served by the perennial system. If Rs. 3-12-0, the mean composite rate for *abiana* worked out above, were added to the land revenue flat-rate of Rs. 2-8-0, the total land revenue and water-rate per acre would work up to Rs. 6-4-0 on the perennial system, as shown by the Irrigation Department by applying the lower schedule.

I agree with the view† of the Irrigation Department that if the people are agreeable the fixed well assessment can be converted into fluctuating assessment of Re. 1-10-0 per matured acre for *chahi*, also that no additional charge for *chahi-nahri* be made, but as pointed out by His Excellency, in the concluding portion‡ of his note, referred to above, this can be considered later on and according to this the rate should be Re. 1-12-0 per matured acre.

NON-PERENNIAL.

11. In view of the slight alterations in the *abiana* rates and percentages of the croppings, which I have proposed, in respect of the non-perennial areas, the mean composite rate, as worked out by the Irrigation Department may be slightly altered.

<i>Kharif</i> .	annas.
Cotton, 35% of Rs. 5	= 28
Sugarcane, 4% of Rs. 6	= 3.8
Rice, 10% of Rs. 4-12-0	= 6
Maize, <i>jowar</i> , <i>baṛa</i> , 63% of Rs. 2-4-0	= 2.2
Other <i>kharif</i> crops, 15% of Rs. 4-8-0	= 10.8
Fodder, 30% of Rs. 2	= 9.6
Composite <i>kharif</i> rate	= 60.4 = Rs. 3-12-0

<i>Rabi</i> .	annas.
Wheat, 65% of Rs. 2-4-0	= 23.2
Toria, <i>Sathri</i> , 2% of Rs. 2-4-0	= .7
Fodder, 15% of Rs. 2	= 4.8
Other <i>rabi</i> crops, 18% of Rs. 2-4-0	= 6.5
Composite <i>rabi</i> rate	= 35.4 = Rs. 2-3-0

Ratio *kharif* to *rabi* 1 : 1
Kharif *abiana* = Rs. 3-12-0
Rabi *abiana* = Rs. 2-3-0
 Total Rs. 3-12-0 + 2-3-0 = Rs. 5-15-0

Mean composite rate for the year Rs. $\frac{5.15}{2}$ = Rs. 2-15-0 The mean composite-

rate worked out above is slightly less, that is by 0-2-0 than that worked out by the Irrigation Department, which is Rs. 3-1-0.

As pointed out by His Excellency, in the concluding portion of his note, the fluctuating land revenue rates and the fixed well assessment will remain as at present.

To this will be added, the mean composite *abiana* rate, calculated above, for the purposes of obtaining the total receipts under both heads (land revenue and water-rate). The actual realizations under all heads will, of course, be deducted and the balance will be the net revenue.

Early orders may kindly be passed so that the financial forecast may be proceeded with.

MOHD. IHSAN ULLAH—26-7-35.

To. S.S. F. C. D.

Revenue Officer on Special Duty, Haveli Project.

* Page 115. † Page 118. ‡ Para. 8, Page 116.

Statement VII* has been added row. Are the figures given in it substantially correct according to your record? Early please.

H. D. BHANOT—29-7-35.

To The Revenue Officer on Special Duty.

S.S., F.C.D.

I have got the figures of the following years 1920-31, 1931-32, 1932-33 and 1933-34. The only year with which I can compare the figures of statement No. VII* given to you by the Irrigation Department is 1930-31. They have not taken the figures after 1920-31. I give below Irrigation Department figures and mine:—

	Year.	Gross area.	Culturable proprietary.	AREA IRRIGATED.		AREA MATURD.		Total matured.	Total irrigated.
				Kharif.	Rabi.	Kharif.	Rabi.		
Irrigation	1930-31	acres 110,848	acres 395,620	acres 138,669	acres 135,362	acres 90,486	acres 89,401	acres 170,887	acres 274,031
Revenue	1930-31	457,104	401,194	138,463	135,238	90,352	89,446	179,798	273,701
Difference		+37,256	+8,805	—206	—124	—134	+45	—89	—330

You will please see that there is a small difference in the area irrigated and area matured.

There is a marked difference in gross area and to some extent in culturable area.

I have consulted Mr. Kanwar Sain. At present no explanation about this difference is forthcoming. It may be possible that the Irrigation Department has excluded Government waste and the area not fit for cultivation from the gross area. As regards culturable area the difference is probably due to the fact that the Irrigation Department has excluded uncommanded area and we have no information about this uncommanded area. The statement under reference also shows that gross and culturable commanded areas have been entered. So far as percentages are concerned, the average of 4 years of my figures is as follows:—

	Gross area.	Culturable proprietary	AREA IRRIGATED.		Total.	AREA MATURED.		Total.
			Kharif.	Rabi.		Kharif.	Rabi.	
1	2	3	4	5	6	7	8	9
	acres 457,104	acres 401,194	acres 137,305	acres 167,627	acres 304,932	acres 91,176	acres 119,120	acres 210,305
Deduct Govt. waste	26,405	..	..	..	..	..	..	..
Net proprietary ..	430,699	..	..	..	..	..	..	..

I have deducted Crown waste and the following averages are the result:—

Percentage of Col. 6 on gross area 71%.

Percentage of Col. 6 over C. C. A. 75%.

Percentage of Column 9 over gross area 49%.

Percentage of Column 9 over culturable area 52%.

My surmise that the Irrigation Department has excluded Government waste is correct.

I can safely say that our areas are correct and the difference may be due to the fact that in this statement the Irrigation Department has taken the average of 10 years and our figures are the result of 4 years' average.

MOHD. INSAN ULLAH—31-7-35.

To S.S. F. C. D.

O. S. D. Revenue.

Note, dated the 7th August 1935, by Mr. H. D. Bhanot, I.C.S., Senior Secretary to the Financial Commissioner, Development.

This case relates to the proposed water and land revenue rates on the Haveli project. The Chief Engineer, Irrigation Branch, proposals will be found on pages 117 and 118. Although Officer on Special Duty, Revenue, has not yet submitted his detailed report, he has commented on Chief Engineer's proposals in his notes, dated the 26th July 1935 and the 31st July 1935 and has made use of the figures collected by him. I will take up water-rates first.

APP. E-II

Water-Rates.

2. I give below the proposed rates for irrigation by flow. Lift rates will be half of flow-rates :—

CROP.	1. B. RATES BASED ON S. V. P. RATES.		1. B. ALTERNATIVE RATES.		O. S. D. REVENUE'S PROPOSED RATES.	
	Perennial.	Non-perennial.	Perennial.	Non-perennial.	Perennial.	Non-perennial.
1	2	3	4	5	6	7
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Sugarcane ..	11 0 0	9 0 0	7 0 0	5 0 0	7 0 0	5 0 0
Rice ..	6 8 0	6 8 0	5 4 0	5 4 0	4 12 0	4 12 0
Indigo, tobacco and spices	6 4 0	6 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Cotton ..	5 4 0	5 4 0	5 4 0	(1) 5 4 0	5 0 0	5 0 0
Kharif gardens and vegetables ..	5 8 0	5 8 0	5 4 0	5 4 0	5 4 0	5 4 0
Wheat ..	4 4 0	2 4 0	3 8 0	2 4 0	3 8 0	2 4 0
Barley and oats ..	5 4 0	2 4 0	3 8 0	2 4 0	3 8 0	2 4 0
Maize ..	4 4 0	4 4 0	4 0 0	4 0 0	3 4 0	2 4 0
Melons ..	5 0 0	5 0 0	(2) 5 4 0	5 4 0	4 12 0	4 12 0
Oil-seeds ..	4 4 0	K. 4 4 0 R. 2 4 0	3 8 0	2 4 0	3 8 0	2 4 0
Bajra, gram and pulses ..	3 4 0	2 8 0	(3) 3 8 0	2 4 0	3 4 0	2 4 0
Fodder ..	2 8 0	2 0 0	2 0 0	2 0 0	2 0 0	2 0 0

3. With the water available, it is anticipated, that the cropping ratio in *kharif* and *rabi* will be 1 : 1.33. The existing and anticipated percentages of main crops according to Irrigation Branch figures is given in statement III.* For facility of comparison, I give below, the percentages according to Officer on Special Duty, Revenue's figures :—

(1) Perennial Kharif.

CROP.	IRRIGATION BRANCH.		OFFICER ON SPECIAL DUTY, REVENUE.	
	Existing.	Anticipated.	Existing.	Anticipated.
Cotton ..	36	45	41	45
Rice ..	12	2	7	4
Sugarcane ..	2	5	3	7
Other <i>kharif</i> crops ..	18	18	23	24
Fodder ..	32	30	26	20

(2) Perennial Rabi.

Crop.	IRRIGATION BRANCH.		OFFICER ON SPECIAL DUTY, REVENUE.	
	Existing.	Anticipated.	Existing.	Anticipated.
Wheat ..	65	65	65	65
Other <i>rabi</i> crops ..	15	25	19	25
Fodder ..	20	10	16	10

(1) Reduced to Rs. 5/- by His Excellency.

(2) Reduced to Rs. 5/- by His Excellency.

(3) Reduced to Rs. 3/4/- by His Excellency.

J.D.H. BEDFORD.—7-9-35. C.E.C.

Viz. pages 122A

(3) *Non-perennial Kharif.*

Crop.	IRRIGATION BRANCH.		OFFICER ON SPECIAL DUTY, REVENUE.	
	Existing.	Anticipated.	Existing.	Anticipated.
Cotton ..		35	31	35
Rice ..	See cols. 3 to 7 of statement III.*	10	11	10
Sugarcane ..		2	2	4
Other <i>kharif</i> crops ..		18	18	21
Fodder ..		35	38	30

(4) *Non-perennial Rabi.*

Crop.	IRRIGATION BRANCH.		OFFICER ON SPECIAL DUTY, REVENUE.	
	Existing.	Anticipated.	Existing.	Anticipated.
Wheat ..	See cols. 3 to 7 of state- ment III.*	65	65	65
Other <i>rabi</i> crops ..		20	13	20
Fodder ..		15	22	15

It will be observed that there is not much difference in the anticipated percentage of cropping in the Irrigation Branch and Officer on Special Duty, Revenue's figures, but there is considerable difference in the case of some crops in the existing percentage. It must, however, be remembered that the Irrigation Branch figures are based on 10 years' average, whereas Officer on Special Duty, Revenue's figures are based on the average of 4 years. At the same time it will be seen that the anticipated increase in cotton will be from 36 per cent. to 45 per cent. according to the Irrigation Branch figures and from 41 per cent. to 45 per cent. according to the Officer on Special Duty, Revenue's figures. Wheat will remain constant at 65 per cent. It may, therefore, be argued that there is no case for an increase in water-rates. But I will show later that under the existing system of irrigation the percentage of remissions is very high and with the stability of weir-controlled irrigation remissions will be much lower. At the same time the percentage of anticipated cropping has been adopted at a very modest rate, but it is better to take a conservative view in framing the forecast of a canal project.

The composite water-rate for the purposes of framing the financial forecast, based on the rates given in para. 2 of this note, and the percentages of cropping given above, works out as follows:—

		<i>Perennial.</i>	<i>Non-perennial.</i>
		Rs. a. p.	Rs. a. p.
Sutlej Valley rates ..		4 4 0	3 3 0
Irrigation Branch alternative rates ..		3 12 0	3 1 0
Officer on Special Duty, Revenue's rates ..		3 12 0	2 15 0

4. According to statement VII† which gives the figures collected by the Irrigation Branch for 11 years, i.e., from 1920-21 to 1930-31, 73·26 per cent. of the culturable commanded area is irrigated at present on the Sidhnai canals and 57·61 per cent. matures. According to Officer on Special Duty, Revenue's figures, giving average of the last 4 years, 75 per cent. of the culturable commanded area is irrigated on the Sidhnai and 52 per cent. matures. The difference between the Irrigation Branch figures and Officer on Special Duty, Revenue's figures is not very great and the Irrigation Branch figures which are an average of 11 years may be taken as a better guide. This area will in future receive perennial irrigation and I understand from the Officer on Special Duty, Irrigation Branch, that the irrigation intensity will be 89·4 per cent. of the culturable commanded area which means that approximately 84 per cent. maturity will be achieved. The figures given above show that at present the percentage of remissions is very high. This must be the result of unstable irrigation. With weir-controlled irrigation stability will be assured.

* Page 137.

† Page 111.

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In the area to receive non-perennial irrigation, the irrigation intensity on the culturable commanded area will be as follows:—

(1) *Left bank.*

- (a) Area already receiving inundation irrigation, 82 per cent., which means *kharif* 41 per cent. and *rabi* first watering 41 per cent.
- (b) New areas 60 per cent., which means 30 per cent. *kharif* irrigation and 20 per cent. first watering for *rabi*.

(2) *Right bank.*

50 per cent. which means 25 per cent. *kharif* irrigation and 25 per cent. first waterings for *rabi*, both for the existing inundation areas and new areas.

There does not, therefore, appear to be any reason why the water-rates on the Haveli project should not be the same as on the Sutlej Valley project, where irrigation intensity is 60 per cent. of the culturable commanded area. I will quote here paragraph 40 of the Resolution by the Governor in Council on the *Abiana* Committee's Report:—

"The Legislative Council has taken great interest in two new irrigation projects, the Bhakra Dam scheme and the Haveli project. The Governor in Council must make it clear, that he retains discretion to fix the rates for new schemes at a level, which will make them remunerative, even if that scale should be higher than the scale, which will result from the reductions which he now proposes to make."

5. In para. 6* of his note, dated the 26th July 1935, Revenue Officer on Special Duty raises the question whether the water-rates can be enhanced. According to him under the existing circumstances enhancement can be effected with the consent of the rate-payers. He has quoted no authority in support of this. I myself am not aware of any provisions that the increase in water-rates is subject to the consent of the irrigators. In fact, para. 6 of the Government orders on the Final Settlement Report of the Multan district says that on the Sidhnai canals fluctuating assessment of canal irrigated lands will be subject to modification and if necessary to the addition of occupiers' rates, if perennial irrigation is ever introduced. In the Nili Bar colony, before the introduction of weir-controlled irrigation, there was irrigation by inundation canals in certain parts. With the introduction of weir-controlled irrigation enhanced water-rates were introduced without obtaining the consent of irrigators. The simple principle is that Government is prepared to give water at certain prices. If any one utilises that water for irrigating his land, he becomes liable to pay the rate fixed by Government. Therefore so far as water-rates are concerned, I am of opinion that there is no obstacle in increasing them.

In paragraph 7†, Revenue Officer on Special Duty suggests that for the first five-years of irrigation from the Haveli project the water-rates should be the existing rates plus half of the rates proposed by him. Obviously the idea underlying this proposal is to see how the project gets on. I do not agree with this proposal. Whatever the state of irrigation, it will be almost impossible to increase the rates after 5 years.

6. His Excellency has dealt with water-rates in paragraph ‡ of his note on the Haveli project, dated the 1st April 1935. Taking into consideration the proposed irrigation intensity, given in para. 4 of this note, the third factor, that in winter it will still be necessary to use wells to a considerable extent, disappears from the area which is to receive perennial irrigation. The first factor, that appropriate rates should be fixed, having regard to those in force on similar canals, gives rise to the conclusion, that there should be no differentiation in the water-rates on the Haveli project and the rest of the province. If the second factor, i.e., the undesirability of making too sharp and sudden an increase on present rates in the Sidhnai must be taken into consideration, the alternative rates proposed by the Irrigation Branch should be adopted.

7. My conclusions for water-rates, therefore, are:—

(1) There is no reason for not applying to the Haveli project the water-rates in force in the rest of the province.

(2) If it is undesirable to make too sharp and sudden an increase on the present rates, the reduced rates proposed by Irrigation Branch and given in columns 7 and 8 of statement II‡, and in para. 2 of this note, may be adopted with the following modifications:—

- (a) the proposed perennial rate for melons, i.e., Rs. 5-4-0 should be reduced to Rs. 5, which is the rate in the rest of the province;
- (b) similarly the proposed perennial rate for *bajra*, gram and pulses, i.e., Rs. 3-8-0 should be reduced to Rs. 3-4-0.

(3) Officer on Special Duty, Revenue's slightly reduced rates for rice, cotton, maize, melons, *bajra*, gram and pulses need not be accepted, because they make no difference in the composite *abiana* rate for the perennial area and result in a difference of Re. 0-2-0 in the composite water-rate for non-perennial area. Moreover there is already a strong case for charging on the Haveli project the rates in force in the rest of the province.

* Page 110.

† Page 120.

‡ Page 116.

§ Page 130.

(4) The proposal, that for the first 5 years existing rates plus half of the new rates should be charged, need not be accepted.

Land Revenue Rates.

8. In the non-perennial area, the existing rates of land revenue will remain in force.

9. For the perennial area please see paras. 7 and 8 of His Excellency's note*. The rates suggested by His Excellency have been adopted by Irrigation Branch and Officer on Special Duty, Revenue.

I have only one suggestion to make. The lump sum well assessment in the area, which is to receive perennial irrigation, should be abandoned altogether. I speak from my experience of the Nili Bar colony, where, in the perennial proprietary area, the wells have gone out of use altogether, and owing to this lump sum well assessment they are not used even in severe scarcity of canal water. In the perennial area of the Haveli project, if the anticipated irrigation intensity of 89.4 per cent. is achieved, there will never be any need of using wells, but, if there is ever scarcity of water, Government will undoubtedly gain by doing away altogether with the lump sum well assessment. In paragraph 6 of Government orders on the Final Settlement Report of the Multan district, the fixed assessment on those wells, which may get perennial canal irrigation, has been guaranteed for 30 years, but this does not prevent Government from abandoning the fixed lump sum assessment on wells in the perennial area. In any case I would suggest that the *vahri* and *chahi-nahri* rates in the perennial area should be the same even if the flat rate is raised from Rs. 2-8-0 to Rs. 3-0-0 per matured acre. For purely *chahi* cultivation the lump sum well assessment may remain in force, but as stated by His Excellency in para. 8 of his note it can be converted into a fluctuating rate of Rs. 1-12-0 per matured acre with the consent of the proprietors.

10. For the Crown waste area in the Haveli project, Chief Engineer has not proposed any land revenue rates, nor has Officer on Special Duty, Revenue touched this point. Perhaps both of them were under the impression, that in view of His Excellency's note the flat rate of Rs. 2-8-0 per matured acre would apply to the perennial Crown waste area, but a rate has to be proposed for the non-perennial Crown waste area. In the Nili Bar colony rate of land revenue on Crown waste area is:—

Perennial Rs. 3-8-0 per matured acre,

Non-perennial Rs. 1-12-0 per matured acre.

Discretion has been given to the Colonization Officer to impose a lower rate in the case of manifestly inferior *bullar* land. The question for decision is whether the Nili Bar rates should be applied to the Haveli project. In my opinion the flat rates sanctioned for the Nili Bar colony have proved too high. The rate of Rs. 3 per matured acre has been provisionally approved for the Crown waste area on the Burala Branch Extension when it receives perennial irrigation. I think this rate may be approved for the perennial Crown waste area on the Haveli project and half of it for the non-perennial Crown waste area.

H. D. BRANOT,—7-8-35.

S. S. F. C. D.

To F. C. D.

Note, dated the 10th August 1935, by Mr. B. H. Dobson, C.B.E., I.O.S. Financial Commissioner, Development.

Senior Secretary has summarised in the foregoing note all the points on which orders are required in this reference from the Canal Department. I add my own comments:—

(1) I agree that *prima facie* the water-rates to be applied on the Haveli project should be those applicable to the Sutlej Valley project.

The principal argument in favour of this course is the merit of uniformity throughout the province. The Haveli lands will also apparently get an abundant supply with much less remission as will appear from the following figures:—

PRESENT INTENSITY.

	Sown.	Matured.
Sidhmni canal	73.26—75%	52—57.61%.

(Variation is due to the difference between Irrigation Branch and Revenue Officer on Special Duty's figures which, however, relate to different cycles of years.)

FUTURE ESTIMATED INTENSITY.

	Sown.	Matured-
Perennial	89.4%	84%

Non-perennial:—

	Old inundation:	New areas.
Left bank	82% sown	60% sown
Right bank	50% „	50% „

(5 per cent. may be allowed in both cases for *kharaba*).

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These figures show that there is no particular necessity on economic grounds to introduce a lower schedule of occupiers' rates. If, however, such policy be considered expedient, I would adopt the Irrigation Branch rates without the modifications suggested by the Revenue Officer on Special Duty in regard to rice, cotton, maize and melons. These changes are slight and do not appear either to myself or to Senior Secretary to be fully justified. As recommended by Senior Secretary, however, I would not sanction the increases proposed by Irrigation Branch in the case of melons, *bajra*, gram and pulses over the Sutlej Valley project rates.

His Excellency was impressed with the necessity for not sanctioning too sharp an increase on present rates. It may, however, be borne in mind that this has already occurred on the Burala Extension and any delay in imposing full rates will make it difficult to apply them at all. In most cases the land revenue is very low, even the enhanced rate of Rs. 2-8-0 on the Sidhnai being no greater than the rates on similar lands in neighbouring districts.

I need only say on the subject of water-rates that, like Senior Secretary, I am not aware of any obstacle to the imposition of enhanced rates with or without the consent of cultivators concerned.

(2) Land Revenue.

There is not much to add to the orders already passed by His Excellency on this subject. There seems, however, to be no necessity for a supplement of 0-12-0 on *chahi-nahri* cultivation, and I would encourage maintenance of wells by abandoning this assessment as well as the lump sum well assessment. This is supported both by Senior Secretary and Irrigation Branch. Incidentally, it will make the new high schedule of water-rates more acceptable in the Sidhnai area.

There is no doubt in my mind that Rs. 3 per acre matured may be approved for all Crown waste, with half the sum for non-perennial.

B. H. DOBSON--10-8-35.

F. C. D.

To H. M. R.

Note, dated the 23rd August 1935, by the Hon'ble K. B. Nawab Muzaffar Khan, C.I.E., Revenue Member.

The difficulty that one feels in fixing the water-rates in the Haveli area is, that both the perennial and non-perennial areas proposed to be irrigated under the new scheme are already partially irrigated by the Sidhnai and the Chenab inundation canals, and in proposing new rates we cannot altogether ignore the rates at present in force on these canals. The case would have been different, if it were an entirely new area brought for the first time under canal irrigation. Government could in that case fix the rates which appeared to them to be reasonable and commercially sound, and leave it to the people to take water or not as it suited them. Under section 36 of the Northern India Canal and Drainage Act such occupiers as accept the water must pay for it accordingly. In the present case the people can, if the new rates are too high, with some justification say that they were quite happy with their existing irrigation conditions and their present water-rates and did not want any change. For these reasons and with his usual sympathy for the zemindars His Excellency laid stress on the undesirability of too sharp and sudden an increase on the present rates, and suggested the addition of a reasonable increase on account of improved water supply; and that throughout the calculation no assumption should be made that Government was carrying this project out in order to compensate for any losses that may have resulted from the Triple project. The estimates must be made on their merits having regard to the conditions which the project will create and the rates which it is reasonable for Government to charge. It would not, therefore, be wise to start with the Sutlej Valley project rates. There is already a strong feeling that the Sutlej Valley project rates particularly in non-perennial areas are too high. We should not, at the same time, forget that the Sutlej Valley project rates were fixed at a time when prices were high and the people did not find much difficulty in paying those rates.

2. The case should, therefore, be examined on its own merits. Taking only the principal crops, I find that there is a great deal of difference between the current and the proposed rates. The Irrigation Branch have suggested Sutlej Valley rates and, failing these, alternative rates with which (with minor modifications) Mirza Ihsan Ullah Khan agrees, though with some hesitation. In his note*, dated the 26th July, he suggests various methods to make the rates acceptable to the people. This shows that there is likely to be a good deal of outcry against the proposed rates. The rates of the principal crops are:—

SIDHNAI CANAL.			
	S. V. P. rates.	Alternative rates proposed.	Current rates in Sidhnai area.
Cotton	5-4-0	5-4-0	Half of consolidated rates. Rs. 2-1-0
Wheat	4-4-0	3-8-0	
Sugarcane	11-0-0	7-0-0	

* Page 119.

His Excellency will observe that the rates have been more than doubled as compared to Sutlej Valley project and in the case of sugarcane they are more than three times even as compared to the rates proposed in the alternative and more than 5 times as compared to the Sutlej Valley project rates. A glance at statement II on page 136 would show the difference in the present, the Sutlej Valley project and the alternative rates.

3. On merits, there is no doubt that with weir-controlled irrigation there will be a vast improvement in the supply of water which at present is somewhat irregular and uncertain. With 2,750 cusecs of water from March to November the maturity of rice, cotton, fodder and other minor crops would be a certainty. Sugarcane would require one more watering after December: crushing continues till March. From December to February the water supply will be reduced to 1,000 cusecs and consequently wells will have to be worked during the period. In the case of wheat, the only principal winter crop, the percentage of maturity has been taken to be the same as at present and will, except for sowing and one watering before December, depend mainly on well irrigation. Further reduction is, therefore, desirable in the case of wheat. These are, I believe, good reasons for not applying to Haveli the water-rates in force in the Sutlej Valley project, which could be put forward in case of any demand from that area for equal treatment.

4. In the case of non-perennial areas, the present irrigation conditions from inundation canals are most unsatisfactory; water is generally not available till the 15th of May and dries up in the middle of September. Under the new conditions there would be a regular supply of water from the 15th April to the 15th or perhaps 30th of October. The rice, the fodder and the minor summer crops would be a certainty and a decided gain in the case of sowing and proper irrigation of cotton and sugarcane. The maturity of sugarcane would again depend on wells and at least two waterings would be necessary (as against one in the case of perennial areas). The rates in the case of non-perennial areas should, therefore, be slightly lower as compared to perennial areas.

5. Considering the special circumstances, I think, we will have to take the people of these areas into our confidence to a certain extent. We need not actually consult them. Such a procedure would lead to useless discussion and unnecessary criticism; but a note describing the present conditions and the improvement that will result in the supply of water under the new conditions and consequent increase in water-rates may perhaps be useful.

MUZAFFAR KHAN—23-8-35.

H. M. R.

To H. E.

Note, dated the 2nd September 1935, by His Excellency Sir Herbert William Emerson, K. C. S. I., C. I. E., C. B. E., I. O. S., the Governor of the Punjab.

I propose to take the Sidhuni Circle of the Kabirwala tahsil as the best circle for comparison with conditions as they will exist under the Haveli system of perennial irrigation, and to leave out of account the subsidiary canals, i.e., Kuranga, Fazil Shah and Abdul Hakim.

The consolidated rates sanctioned at last settlement were as follows:—

Class I crops—Rs. 4-6-0 per acre matured.
 „ II crops—Rs. 3-8-0 per acre matured.
 „ III crops—Rs. 2-12-0 per acre matured.

The classes of crops were as follows:—

Class I—Pepper;
 Cotton;
 Til;
 Sugarcane;
 Wheat;
 Tobacco;
 Fruits and
 Vegetables.

Class II—Rice only.

Class III—All other crops.

In addition, a fixed assessment was placed on the wells, which was based on the following rates:—

chahi—Rs. 1-14-0 per acre matured.
chahi-nahri—Rs. 0-14-0 per acre matured.

If we want to get the average rate per *chahi nahri* acre matured at present in force, we have, therefore, to add Rs. 0-14-0 to the rates above given. Thus, the *chahi-nahri* rate for wheat and cotton (the two most important crops) is Rs. 4-6-0+0-14-0=5-4-0;

2. The position, as regards the areas which will come under perennial irrigation, is that we can split up the fluctuating consolidated rate into its component parts of land revenue and water-rates; and we can increase either or both of these. We cannot, however, alter the fixed assessment on the wells without the consent of the zemindars, since the fixed well

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assessment was guaranteed for 30 years. There will, however, be no difficulty in getting the consent of the zemindars to give up the fixed well assessment, if we offer them sufficiently liberal terms.

3. I may say at once that I prefer the reduced water-rates proposed by the Irrigation Department, provided that they are sufficiently high to make the project as a whole remunerative. If they are not sufficiently high for this purpose, then it may be necessary to adopt the Sutlej Valley project rates as they stand. As the Hon'ble Member, Revenue, has observed, we are not starting with a clean slate, and we must pay some regard to existing rates. This is the more necessary in the Multan district, because the people are well aware of the disappointing results on the Sutlej Valley canals. Adopting the reduced rates, we can compare, for different crops, the proposals of the Irrigation Branch, taken with my proposals for land revenue, with existing rates. The main crops we have to consider are:—

Cotton;
Wheat; and
Fodder.

The comparison is as follows:—

Crop.	EXISTING RATES.		PROPOSED RATES.					
	Nahri.	Chahi-nahri.	Nahri.			Chahi nahri.		
			Land revenue.	Water-rate.	Total.	Land revenue.	Water-rate.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Cotton ..	4 6 0	5 4 0	2 8 0	5 4 0	7 12 0	3 4 0	5 4 0	8 8 0
Wheat ..	4 6 0	5 4 0	2 8 0	3 8 0	6 0 0	3 4 0	3 8 0	6 12 0
Fodder ..	2 12 0	3 10 0	2 8 0	2 0 0	4 8 0	3 4 0	2 0 0	5 4 0

Or, put briefly, the comparisons are as follows:—

Crop.	Existing combined rates.		New combined rates.	
	Nahri.	Chahi-nahri.	Nahri.	Chahi-nahri.
	Rs.	Rs.	Rs.	Rs.
Cotton ..	4-6-0	5-4-0	7-12-0	8-8-0
Wheat ..	4-6-0	5-4-0	6-0-0	6-12-0
Fodder ..	2-12-0	3-10-0	4-8-0	5-4-0

For sugarcane—the comparison is

	Now.	Proposed.
Nahri ..	Rs. 4-6-0	Rs. 9-8-0
Chahi-nahri ..	Rs. 5-4-0	Rs. 10-4-0

4. It will thus be seen that, while the increases proposed on individual crops are considerable, the increases in land revenue and water-rate combined are not so large as if comparison were confined to water-rates only, and that, in the case of the important crop of wheat, they are comparatively small.

5. In order to find out what the all-round increase is, we may assume the following figures:—

- The consolidated rate at present on *nahri* is Rs. 3-10-0 per acre matured.
- The additional charge on *chahi nahri* is Re. 0-14-0 per acre matured.
- The average water-rate proposed is Rs. 3-12-0 per acre matured.
- The average rate of land revenue proposed is Rs. 2-8-0 per acre matured on *nahri* plus an additional charge of Re. 0-12-0 on *chahi-nahri*.

The all-round comparison is thus as follows:—

	Now.	Proposed.
Nahri ..	Rs. 3-10-0	Rs. 6-4-0
Chahi-nahri ..	Rs. 4-8-0	Rs. 7-0-0

Here again, the increase is substantial, but not so large as that given by a comparison of half the consolidated rate with the proposed water-rates.

6. For the non-perennial area, I take for purposes of comparison the Uttar circle of the Multan tahsil. The all-round revenue rate sanctioned for *nahri* at last Settlement was Rs. 1-10-0 per acre matured, to which must be added Rs. 1-2-0 for *chahi-nahri*. The occupiers' rates at present in force for the main crops are:—

Sugar-cane	..	Rs. 3-0-0
Cotton	..	Rs. 2-4-0
Wheat	..	Rs. 1-2-0
<i>Kharif</i> fodder	..	Rs. 1-8-0
<i>Rabi</i> fodder	..	Rs. 1-2-0

Under the new system, the land revenue will remain unchanged, and, taking land revenue and water-rates together, the comparison for various crops is as follows:—

			Now.		Proposed.	
			<i>Nahri</i>	<i>Chahi-nahri</i>	<i>Nahri</i>	<i>Chahi-nahri</i>
Sugarcane	..	..	4-10-0	5-12-0	7-10-0	8-12-0
Cotton	..	..	3-14-0	5-9-0	6-14-0	8-0-0
Wheat	..	..	2-12-0	3-14-0	3-14-0	5-0-0
<i>Kharif</i> fodder	..	..	3-2-0	..	3-10-0	..
<i>Rabi</i> fodder	..	..	2-12-0	3-14-0	3-10-0	4-12-0

It is not possible to make a comparison of the all-round rate now and in future, since figures are not available showing the present all-round incidence of water-rates.

Spoken to H.E. Wa
should work on a
proportion of 100 to
133 or approximate-
ly 43 to 57.

MUZAFFAR KHAN,
H.M.R.
3. 9. 35.

7. With regard to cropping on the perennial canals, I would assume that the ratio of *kharif* to *rabi* will be 45 : 55 ; and I would take the following crop percentages expressed as percentages of the total matured area, and not of the *kharif* and *rabi* separately, namely:—

Cotton	..	22			
Rice	..	2			
Sugarcane	..	3			
<i>Kharif</i> fodder	..	9			
Other <i>kharif</i> crops	..	9	Total <i>kharif</i> crops	..	45
Wheat	..	38			
Other <i>rabi</i> crops	..	12			
<i>Rabi</i> fodder	..	5	Total <i>rabi</i> crops	..	55
			Total	..	100

The chief change in these figures, as compared with those given by the Officer on Special Duty, Revenue and Irrigation Branch, is that the proportion of cotton I assume is rather higher than what they assume. My reason for this is that there will be plenty of water, both for sowing and maturing, and experience has shown that, in the areas where this has occurred in the past on the Sidhna, the proportion of cotton has been high. Also, in present circumstances, cotton is a crop which is given very high *kharaba*. I have also raised the proportion of *kharif* to the whole matured area. The justification for this is the reasons given above, and also, under the present system, far higher remission is given in the *kharif* than in the *rabi*. In fact, I doubt very much whether 45 per cent. is a sufficiently high proportion for *kharif*. It will, however, do for the purposes of the financial estimate.

8. When we come to the non-perennial area, the effect of a good *kharif* supply will be to raise the proportion of the *kharif*, and, in particular, of the area under cotton. On the other hand, there may be some difficulty in maturing cotton. Assuming that *kharif* and *rabi* will be equal in area, I would take the following cropping figures:—

Cotton	..	18			
Rice	..	4			
Sugarcane	..	2			
<i>Kharif</i> fodder	..	14			
Other <i>kharif</i> crops	..	12	Total <i>kharif</i> crops	..	50
Wheat	..	33			
<i>Rabi</i> fodder	..	9			
Other <i>rabi</i> crops	..	8	Total <i>rabi</i> crops	..	50
			Total	..	100

APP. E-II

9. As regards the advantages from perennial irrigation, as compared with the Sidhnai, these may be stated briefly as follows:—

- (a) Much greater security.
- (b) Far less failure of crops.
- (c) Far less variation in the cropping. The farmer will be able to depend on a regular supply of water, and can make his arrangements accordingly. Under the present system, conditions may be such as to allow him to sow very little *kharif*, even though the prices of cotton may be high.
- (d) A regular supply of water in the *rabi*, which will enable him, within certain limits, to make large sowings, in the certainty that he will be able to mature them. He will still have to work his wells for a part of 3 months in the year; but this does not mean that he will get no canal water during those 3 months, and he will always be sure of getting water during the critical period when the crop is maturing. Since he will not have to use his wells so much as at present, he need not keep so many well cattle.

These are very substantial benefits.

10. So far as the non-perennial areas are concerned, the chief advantages are:—

- (a) A certain supply in the *kharif*, which will enable him largely to increase the area under cotton, although, in comparison with the perennial areas, he will have to grow more *Desi*, and less American, cotton.
- (b) A certain supply for *rabi* sowings, which, in practice, will be limited only by the capacity of his wells to mature the area sown.

11. Having regard to the above examination, I would accept the rates of *abiana* given in para. 2* of Mr. Bhanot's note, cols. 4 and 5, with the following modifications:—

Cotton non-perennial Rs. 5, instead of Rs. 5-4.

Melons perennial rate Rs. 5.

Perennial rate for *bajra*, gram and pulses Rs. 3-4-0.

I am not in favour of the proposal to introduce these rates by instalments. Whatever rates are finally sanctioned should be applied from the outset.

12. There remains the question of land revenue. The suggestion is made in the foregoing notes that the fixed well assessment should be abandoned altogether in perennial areas, and, further, that no additional charge should be made on *chahi-nahri*. I am in favour of abandoning the fixed well assessment, if the land-revenue-payers as a body agree to this; but it will not be possible to give up entirely an additional rate on *chahi-nahri*. The reasons are given briefly below.

If we compare the Sidhnai (Kahirwaln) with the Uttar Circle (Multan), we see that in each of these circles, the average fixed well assessment is made up by applying the following average rates to *chahi* and *chahi-nahri*, respectively:—

		<i>Chahi.</i>	<i>Chahi-nahri.</i>
Sidhnai Circle	..	Rs. 1-14-0	Rs. 0-14-0
Uttar Circle (Multan)	..	Rs. 1-4-0	Rs. 1-2-0

In the Sidhnai, the average fixed assessment per well is Rs. 21-6-0.

In the Uttar circle, it is Rs. 25/- to 26/-.

Now, in the non-perennial area, there is no proposal to touch the present system of assessment. In fact, this could only be done with the consent of the people. The fixed well assessment will, therefore, remain in that area. If we abolish it in the perennial area and put on no additional fluctuating rate for *chahi-nahri*, we differentiate very much between the two areas, and there is certain to be a demand for the same treatment in the non-perennial area. Again, both the produce and the rent of *chahi-nahri* land is higher than that of *nahri*, and it is opposed to assessment principles not to make a distinction between the two. Complications would also be introduced in the system of protective leases for wells. For these reasons, the proposal to abolish altogether the *chahi-nahri* rate seems to me impracticable.

At the same time, there are excellent reasons why we should encourage the use of wells in the perennial areas, since, if they are not worked during December, January and February, the *rabi* area sown and matured will be considerably less than it ought to be. Also, the danger of water-logging will be increased. I, therefore, agree that we should encourage the use of wells in perennial areas:—

- (a) By giving land-revenue-payers the opportunity, as a body, of substituting the fixed well assessment for the following fluctuating rates:—

Chahi Rs. 1-8-0 per acre matured.

Chahi-nahri additional 8 annas per acre matured.

In both cases, I have reduced my original proposals by 4 annas per acre matured. With this *chahi-nahri* rate, the perennial area will be much better treated so far as well cultivation is concerned than the non-perennial area; but this is only reasonable, since the wells will be used to a far less extent in the perennial areas;

- (b) also, in order to make the rise in combined land revenue and water-rates less steep than it would otherwise be, I think, we may propose a fluctuating rate of Rs. 2/- per acre matured in the perennial areas, instead of Rs. 2-8-0 per acre matured as originally suggested by me.

13. The only other point which seems to require orders, is the rate for Crown waste. I agree that the rate may be Rs. 3 per acre matured on the perennial canals, and Rs. 1-8-0 per acre matured on the non-perennial canals.

14. The above orders will enable the financial forecast to be calculated afresh, so far as land revenue and water-rates are concerned. But I wish to make it clear that the figures, at present, must be regarded as provisional only. If the rates now proposed do not produce a remunerative scheme, then it will be necessary to raise them until we have got a remunerative scheme. By 'remunerative' I do not mean that we need necessarily satisfy the tests laid down by the Secretary of State for previous projects. Money is now cheap, and if we can produce a scheme which will give a reasonable yield on the money invested, we can still press for its sanction by the Secretary of State, even although it is below the return which was regarded as necessary a few years ago.

15. If there is anything in this note which H.M.R., F. C. D. or Mr. Bedford would like to discuss, we can arrange for a discussion.

H. W. EMERSON—2-9-35.
H. E.

To H.M.R.
F.C.D.
SECR. C.

Note, dated the 7th September 1935, by Mr. J. D. H. Bedford I. S. E., Chief Engineer, Construction Administration, Irrigation Works, Punjab.

As per His Excellency's note para. 7 in margin, the proportion of summer to winter crops has been altered from 45/55 to 43/57. This ratio 43/57 is equivalent to 100 to 133 which is based on cropping calculated according to water available. To carry out the alteration the various crops shown in the note have been altered as shown below:—

Crop.	Percentage.	Rates as approved.	Amount in annas.
Cotton	20	5/4/-	16-80
Rice	2	5/4/-	1-68
Sugarcane	3	7/-/-	3-36
Summer fodder	9	2/-/-	2-88
Other summer crops	9	5/-/-	7-20
Wheat	37	3/8/-	20-72
Other winter crops	14	3/4/-	7-28
Winter fodder	6	2/-/-	1-92
Total	100		61-84
			=Rs. 3-86

Composite rate comes to Rs. 3-86 against Rs. 3-75 proposed by Irrigation Branch.

For non-perennial areas, the proportions of cropping and composite rate as per para. 8* of His Excellency's note are as follows:—

Crop.	Percentage.	Rates as approved.	Amount in annas.
Cotton	18	5 0 0	14-40
Rice	4	5 4 0	3-36
Sugarcane	2	6 0 0	1-92
Summer fodder	14	2 0 0	4-48
Other summer crops	12	4 8 0	8-64
Wheat	33	2 4 0	11-88
Winter fodder	9	2 0 0	2-88
Other winter crops	8	2 4 0	2-88
Total	100		50-44
			=Rs. 3-15

Composite rate comes to Rs. 3-15 per acre against 3-06 proposed by Irrigation Branch.

APP. E-II.

As per para. 12* the land revenue rate under perennial has been reduced from Rs. 2-8-0 to Rs. 2 and a *chahi-nahri* rate of 0-8-0 has been added: now it will not be possible to record *chahi*, *nahri* and *chahi-nahri* separately as nobody can check *chahi-nahri* irrigation with certainty. According to the orders of Government the water in December to February has been reduced to 990 cusecs to insure that wells are used, hence the total winter irrigation for estimating purposes must be taken as *chahi-nahri*. The land revenue rate, therefore, for winter crops will be Rs. 2/-+0-8-0=Rs. 2-8-0 as before; in the summer, however, there will be no appreciable *chahi-nahri* because the canal water supply is ample. In the Multan district non-perennial Hithar assessment circle, at present the flat-land revenue rate for *nahri* land is Rs. 1-12-0 and land revenue rate for *chahi-nahri* land is Rs. 3-10-0, while, for the future, the land revenue in the perennial areas is to be Rs. 2 *nahri* and Rs. 2-8-0 for *chahi-nahri* under conditions where *chahi-nahri* in the summer will not be necessary owing to good water supply. The reduction in perennial land revenue rates as compared with non-perennial may cause difficulties. However, this is a matter that can be considered when the canals are constructed. As regards the forecast it means a reduction of 0-8-0 per acre in land revenue in the summer only, and as this is a factor of safety, it is in that respect good. The composite

land revenue rate will then be $\frac{(1 \times 2.0) \times 1.33 \times 2.5}{2.33} = \text{Rs. } 2.28 \text{ per acre.}$

13. The land revenue rate for Crown waste area has been reduced to Rs. 3 for perennial and increased to Rs. 1-8-0 for non-perennial and these rates have been taken in the revised forecast. The composite land revenue rate for non-perennial areas is based on the existing fluctuating land revenue rates, *vide* statement VI† attached to this Appendix. It comes to Rs. 1-14-0 per acre.

The forecast of receipts for the Haveli area as made by the Irrigation Branch was Rs. 55.39 lacs, the forecast as obtained by re-examination on the Civil side is Rs. 55.45 lacs: net increase is Rs. 6,000 or a percentage of .001. Actually after construction the results may be out by a larger percentage. The percentage return on sum at charge comes to 7.8 per cent. (*vide* Financial Statement VI, Volume I).

J. D. H. BEDFORD—7-9-35.

Chief Engineer, Construction.

As ordered by H.E. the proportion of *chahi-nahri* to *nahri* in the winter is to be taken 1:1, i.e., the composite rate will now be $\frac{(1 \times 2.0) + 1.33 \times 2.5}{2.33} = \text{Rs. } 2.15.$
J.D.H. BEDFORD—
11-9-35.
Chief Engineer,
Construction.

STATEMENT SHOWING LAND REVENUE AND OCCUPIERS' RATES FOR MULTAN, SHUJABAD AND KABIRWALA TAHSILS OF MULTAN DISTRICT.

*In all circles, with the exception of Atrai of Mulan tahsil and Uttar of Kabirwala tahsil, there is lump sum assessment on all crops except pure chahi.
†Rates on the Sidhrai series are consolidated rates, including water-rates.

*In all circles, with the exception of Atrai of Mulan tahsil and Uttar of Kabirwala tahsil, there is lump sum assessment on all crops except pure chahi.
†Rates on the Sidhrai series are consolidated rates, including water-rates.

APPENDIX E-II, STATEMENT II
STATEMENT SHOWING EXISTING AND PROPOSED WATER-RATES

Name of crop.	SUTLEJ VALLEY PROJECT.						EXISTING SUBSIDIARY AND 3 SUBSIDIARY CANALS.			Chenab Left Bank Inundation series.			Chenab Right Bank Inundation series.			LOWER SCHEDULE PROPOSED FOR THE HAVELI CANALS AREA.					
	Perennial.			Non-perennial.			4			5			6			7			8		
	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.	F.	R ^s . a. p.	L.
Sugarcane	11 0 0	5 8 0	1 8 0	9 0 0	1 8 0	1 0 0	2 1 0	2 1 0	1 0 0	3 0 0	3 0 0	2 4 0	1 8 0	0 12 0	0 12 0	7 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
Rice	0 8 0	3 4 0	3 4 0	6 8 0	3 4 0	0 14 0	1 12 0	1 12 0	0 14 0	3 0 0	3 0 0	2 4 0	2 12 0	1 6 0	1 6 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Indigo, tobacco and spices	0 4 0	3 2 0	3 2 0	6 4 0	3 2 0	1 0 0	2 1 0	2 1 0	1 0 0	1 12 0	1 12 0	1 5 0	1 8 0	0 12 0	0 12 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Cotton	5 4 0	2 10 0	3 10 0	5 4 0	3 10 0	1 0 0	2 1 0	2 1 0	1 0 0	2 4 0	2 4 0	1 11 0	1 8 0	0 12 0	0 12 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Kharif gardens and vegetables	5 8 0	2 12 0	2 12 0	5 8 0	2 12 0	0 11 0	1 6 0	1 6 0	0 11 0	3 0 0	3 0 0	2 4 0	2 12 0	1 6 0	1 6 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Wheat	4 4 0	2 2 0	2 2 0	2 4 0	1 2 0	1 0 0	2 1 0	2 1 0	1 0 0	1 2 0	1 2 0	0 13 0	0 12 0	0 6 0	0 6 0	3 8 0	2 4 0	2 4 0	2 4 0	2 4 0	2 4 0
Barley and oats	5 4 0	2 10 0	1 2 0	2 4 0	1 2 0	0 11 0	1 6 0	1 6 0	0 11 0	1 2 0	1 2 0	0 13 0	0 12 0	0 6 0	0 6 0	3 8 0	2 4 0	2 4 0	2 4 0	2 4 0	2 4 0
Maize	4 4 0	2 2 0	2 2 0	4 4 0	2 2 0	0 11 0	1 6 0	1 6 0	0 11 0	1 12 0	1 12 0	1 5 0	1 2 0	0 9 0	0 9 0	4 0 0	4 0 0	4 0 0	4 0 0	4 0 0	4 0 0
Melons	5 0 0	2 8 0	2 8 0	5 0 0	2 8 0	1 0 0	2 1 0	2 1 0	1 0 0	1 12 0	1 12 0	1 5 0	1 2 0	0 9 0	0 9 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0
Oilseeds	4 4 0	2 2 0	2 2 0	4 4 0	2 2 0	0 11 0	2 1 0	2 1 0	0 11 0	Other oil seeds, c.g. 7/11	1 2 0	0 13 0	0 12 0	0 6 0	0 6 0	3 8 0	2 4 0	2 4 0	2 4 0	2 4 0	2 4 0
Bojra, gram and pulses	3 4 0	1 10 0	1 4 0	2 8 0	1 4 0	0 11 0	1 6 0	1 6 0	0 11 0	1 12 0	1 12 0	1 5 0	1 2 0	0 6 0	0 6 0	3 8 0	2 4 0	2 4 0	2 4 0	2 4 0	2 4 0
Fodder	2 8 0	1 4 0	1 0 0	2 0 0	1 0 0	0 11 0	1 6 0	1 6 0	0 11 0	1 12 0	1 12 0	1 5 0	1 2 0	0 6 0	0 6 0	2 0 0	2 0 0	2 0 0	2 0 0	2 0 0	2 0 0

* This rate is for rabi vegetables.

+ Rabi crops watered after 1st November pay Re. 1 per acre for flow and Ans. 0/8/0 per acre for lift irrigation.

F. stands for flow & L. for lift irrigation.

Half the flow rates.

Half the flow rates.

APPENDIX E-II, STATEMENT III.

STATEMENT SHOWING PERCENTAGES OF PRINCIPAL KHARIF AND RABI CROPS ON CERTAIN INUNDATION AND PERENNIAL CANALS.

Crops.	Average of 4 years in some assessment circles of Multan district.	Average of 10 years 1923-24 to 1932-33.		On Ganges canal.	On Talari canal.	On Karan canal.	On Bidhwa canal.	In Jiang division.	In Khanewal division.	PROPOSED PERCENTAGES OF CHOPPING.		COMPOSITE RATES BASED ON S.V.P. SCHEDULE.				COMPOSITE RATES BASED ON LOWER SCHEDULE.			
		On Wah Mohan canal.	On Sikanwar canal.							Perennial.	Non-perennial.	Rate.	Amount in annas.	Rate.	Amount in annas.	Rate.	Amount in annas.	Rate.	Amount in annas.
		3	4																
Kharif.																			
Cotton	..	30	21	8	16	3	36	47	58	45	35	Rs. As.	37-8	5 4	20-4	Rs. As.	37-8	5 4	20-4
Rice	..	9	8	37	22	68	12	..	..	2	10	6 8	2-1	6 8	10-4	5 4	1-7	5 4	8-4
Sugarcane	..	1	1-5	4	12	0-5	2	7	2	5	2	11 0	8-8	9 0	2-0	7 0	5-0	6 0	1-9
Other Kharif crops	..	25	27-5	29	36	10-5	18	23	19	18	13	5 0	14-4	4 8	13-0	5 0	14-4	4 8	13-0
Fodder	..	35	42	22	14	18	32	23	21	30	35	2 8	12-0	2 0	11-2	2 0	9-6	2 0	11-2
Total	..	100	100	100	100	100	100	100	100	100	100	4 11	75-1	4 3	60-0	4 5	60-1	4 0	63-9
Rabi.																			
Wheat	..	65	71	75	77	58	65	66	60	65	65	4 4	44-2	2 4	23-4	3 8	36-4	2 4	23-4
Other rabi crops	..	27	10	23	21	41	15	25	26	25	20	4 0	16-0	2 4	7-2	3 8	14-0	2 4	7-2
Fodder	..	8	19	2	2	1	20	9	14	10	15	2 8	4-0	2 0	4-8	2 0	3-2	2 0	4-8
Total	..	100	100	100	100	100	100	100	100	100	100	4 0	64-2	2 3	35-4	3 6	53-6	2 3	35-4
											Kharif to rabi ratio		1 to 1-3	1 to 1	1 to 1-3	1 to 1	1 to 1-3	1 to 1	1 to 1
											Composite rate on annual irrigation.		Rs. 4-4	Rs. 3-3	Rs. 3-12	Rs. 3-1	Rs. 3-12	Rs. 3-1	Rs. 3-1

APPENDIX E-II, STATEMENT IV.

STATEMENT SHOWING PERCENTAGES OF PRINCIPAL KHARIF AND RABI CROPS ON THE SIKANDARABAD CANAL.

YEAR.	Date of opening.	Date of closing.	Kharif.						Rabi.						
			Cotton.			Rice percentage of total.	Sugarcane percentage of total.	Indigo percentage of total.	Maize percentage of total.	Til percentage of total.	Rodder percentage of total.	Miscellaneous percentage of total.			
			Dead percentage of total.	American percentage of total.											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1923-24	7-4-23	10-10-23	30-0	0-03	21-1	2-4	12-4	-35	-42	25-6	7-7	73-4	5-2	17-6	3-9
1924-25	23-4-24	13-10-24	35-08	0-13	13-0	2-0	0-70	-30	-93	31-4	14-0	60-3	5-3	10-8	5-6
1925-26	1-6-25	11-10-25	35-6	0-71	18-0	2-0	1-3	-37	1-0	20-8	10-9	72-1	3-8	18-6	5-6
1926-27	10-4-26	29-0-26	26-59	0-74	21-0	2-0	5-0	-25	-74	31-5	11-7	68-8	5-7	20-0	5-4
1927-28	22-5-27	30-0-27	26-47	0-34	13-0	3-0	1-0	-35	1-4	38-1	15-9	76-8	2-3	15-8	5-1
1928-29	19-4-28	4-11-28	28-26	3-46	18-0	2-0	6-0	-35	-36	29-0	12-6	71-5	4-0	10-0	5-5
1929-30	20-4-29	26-10-29	28-72	0-57	20-0	1-2	4-5	-30	-00	30-4	13-7	68-6	5-8	21-2	6-4
1930-31	10-4-30	27-0-30	25-72	1-26	10-0	2-5	7-0	-56	-82	34-2	8-3	71-0	6-0	17-5	5-5
1931-32	14-5-31	22-9-31	28-04	1-13	15-0	4-0	2-0	-6	2-1	34-7	12-2	69-6	5-8	10-6	5-1
1932-33	31-5-32	24-9-32	27-1	0-65	13-0	5-7	-77	-81	2-5	36-6	17-7	72-9	3-6	19-2	4-3
Average, 1923-24 to 1932-33.			28-72	0-90	17-1	2-7	4-1	-43	1-2	32-1	12-0	71-2	4-75	18-6	5-2

APPENDIX E-II, STATEMENT V.

STATEMENT SHOWING RATIO OF MAIN CROPS ON THE SIDHAI CANALS.

Name of circle.	Kharif.										Rabi.										
	Sugarcane.	Rice.	Cotton.		Indigo.	Maize.	Jil.	Chillies or pepper.	Podder.	Fruits or vegetables.	Miscellaneous.	Total assessed area.	Wheat.	Toria or arhar.	Gram.	Tobacco % on Kharif assessed area.	Fruits & vegetables.	Podder.	Miscellaneous.	Total assessed area.	
			Desi.	American.																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1923-24	% 1.83	% 14.47	% 30.4	% 13.76		% 1.55			% 27.63		% 9.90	acres. 112,296	% 66.31	% 2.28	% 8.12	% 0.40			% 19.03	% 3.96	acres. 144,267
1924-25	1.21	7.56	20.7	27.02		1.24			29.74		12.23	119,008	68.02	2.37	9.05	0.30		19.54	2.12	167,666	
1925-26	0.74	12.74	14.1	21.03		1.13			30.79		12.53	95,998	67.18	2.27	7.51	0.64		18.90	4.08	104,134	
1926-27	0.80	9.96	14.7	37.16		0.86			15.19		21.61	120,021	67.41	1.68	7.29	0.30		20.18	3.44	157,754	
1927-28	1.60	13.28	10.3	9.83		1.98			42.28		10.91	75,805	64.36	2.05	5.16	0.79		21.89	5.94	115,184	
1928-29	1.39	11.83	10.6	23.07		1.23			32.70		9.91	98,800	67.29	1.16	5.00	0.21		21.59	4.06	10,603	
1929-30	0.75	14.68	12.5	11.84		1.19			33.82		21.01	96,076	63.18	2.61	10.47	0.91		17.31	6.10	162,016	
1930-31	1.90	16.81	18.4	29.65		1.67			21.73		6.11	90,480	63.17	1.45	10.25	0.34		21.59	3.24	89,401	
1931-32	3.01	9.28	12.0	24.10		1.15			31.24		15.59	85,741	63.03	2.05	10.99	0.33		10.01	4.02	141,369	
1932-33	5.01	9.15	4.2	7.53		3.05			42.33		27.59	67,718	63.13	1.21	4.79	0.04		21.21	9.66	88,953	
Average of 10 years	1.84	11.98	13.69	20.49		1.60			32.00		15.89	..	65.17	2.00	8.04	0.51		20.03	4.66	..	

APPENDIX E-II, STATEMENT VI.
STATEMENT SHOWING LAND REVENUE ON PROPRIETARY NON-PERENNIAL AREAS BY ASSESSMENT CIRCLES IN THE HAVELI CANALS AREA.

Name of assessment circle.	Name of tahsil district.	GROSS AREAS.		CULTURABLE COMMANDED AREAS.			PROBABLE IRRIGATION.				Matured areas (Khuraba 10%).	Existing land revenue rate per acre as per Assessment Report.	Amount of land revenue.
		On existing inundation canals.	New proprietary.	On existing inundation canals, 80% of Col. 3.	New proprietary @ 80% of Col. 4.	In areas covered by existing inundation canals @ 82% of Col. 5 on left bank and 30% of Col. 6 on right bank.	In new proprietary areas @ 60% of Col. 6 on left bank and 30% of Col. 5 on right bank.	Acres.	Acres.	Acres.			
<u>Left bank.</u>													
Chenab	Jhang	..	4,037	..	3,240	..	1,918	..	1,918	1,753	2/4/-	3,944	
Joint	Shorkot	..	70,749	..	61,899	..	36,839	..	36,839	33,155	2/4/-	74,599	
Chenab Nahri	Do.	..	18,458	..	14,766	..	9,860	..	9,860	7,974	2/2/-	16,945	
Atraf (with 4 villages of Hithar).	Multan	..	..	17,686	..	14,511	..	..	14,511	13,080*	Land revenue is entirely fixed & therefore is not taken into account for working out composite rate.	..
Sidhnai	Do.	4,222	..	3,800	..	3,116	..	3,116	3,116	2,805	1/12/-	4,900	
Uttar	Do.	84,561	..	79,732	..	65,380	..	65,380	65,380	58,842	1/12/-	102,973	
Hithar (less 4 villages taken with Atraf).	Do.	38,996	9,406	53,096	7,525	43,538	..	43,538	48,053	43,248	1/12/-	75,684	
Uttar	Shujabad	86,978	2,378	78,250	2,062	64,100	1,237	65,427	65,427	58,884	1/12/-	103,047	
Rawa	Do.	10,067	..	9,600	..	7,872	..	7,872	7,872	7,085	1/12/-	12,390	
Hithar	Do.	21,052	9,701	18,917	7,703	15,537	4,658	20,195	20,195	18,175	1/12/-	31,806	
Hithar	Kabirwala	15,703	12,342	14,132	9,873	11,588	5,924	17,512	17,512	15,761	1/10/-	25,612	
Sidhnai	Multan	7,086	1,782	6,277	1,134	5,229	860	6,089	6,089	5,180	1/10/-	8,905	
	Do.	312,036	135,086	281,069	108,068	240,991	61,841	295,802	295,802	296,322	..	460,823	
<u>Right bank.</u>													
Jhelum	Jhang	..	4,374	..	3,199	..	1,750	..	1,750	1,575	2/2/-	3,347	
Kachhi	Do.	..	333	..	206	..	133	..	133	120	2/2/-	255	
Kachhi	Shorkot	..	114,039	..	91,711	..	45,856	..	45,856	41,270	2/2/-	87,009	
Joint	Jhang	1,014	48,398	910	38,716	470	19,359	470	19,829	17,846	2/4/-	40,154	
Bel Chenab	Do.	..	..	..	..	..	..	..	..	..	..	..
	Alipur	6,642	..	5,978	..	2,989	..	2,989	2,989	2,690	2/2/-	5,716	
Pacca	Muzaffargarh	85,063	51,071	77,313	41,237	38,657	20,608	38,657	59,325	53,393	1/12/-	93,438	
Bel Chenab	Muzaffargarh	13,112	23,051	11,801	18,441	5,901	9,221	5,901	15,122	13,009	2/2/-	28,910	
Thal Chakhi-nahri	Do.	403	133	417	122	209	61	270	270	243	1/4/-	304	
	Do.	107,104	242,610	90,418	194,095	18,226	97,048	18,226	143,274	130,746	..	269,832	
	Total right bank	420,120	377,705	378,108	362,163	270,187	161,889	270,187	441,076	396,968	..	720,655	
	Total both banks												

Area for composite rate = 396,968 minus 13,060* = 383,908.

Composite land revenue rate 383,908 = 1/14 /- per acre.

APPENDIX E-II STATEMENT VII.
DATA OF SIDHNAI CANALS (INCLUDING THE KORANGA, FAZIL SHAH AND ABDUL HAKIM SUBSIDIARY CANALS) FOR THE YEARS 1920-21 TO 1930-31.

YEAR.	Gross area commanded in acres.	Culturable area in acres.	AREA IRRIGATED (ACRES).			AREA MATURED (ACRES).			REMARKS.
			Kharif.	Rabi.	Total.	Kharif.	Rabi.	Total.	
1	2	3	4	5	6	7	8	9	10
1920-21	..	380,977	344,130	122,088	77,318	210,006	77,000	31,012	112,572
1921-22	..	420,717	305,259	80,707	157,280	244,053	60,035	133,210	193,245
1922-23	..	420,717	305,259	124,818	204,727	329,545	93,712	101,333	285,045
1923-24	..	430,717	305,259	136,611	160,017	297,558	112,201	144,207	256,558
1924-25	..	410,848	305,620	133,696	100,373	321,069	110,698	167,666	297,364
1925-26	..	410,848	305,620	119,000	103,115	319,114	95,998	104,134	260,132
1926-27	..	410,848	305,620	118,181	184,008	332,489	120,021	157,754	277,775
1927-28	..	410,848	305,620	105,700	117,770	253,539	75,805	115,184	190,989
1928-29	..	410,848	305,620	118,718	144,059	292,777	98,800	106,035	204,835
1929-30	..	410,848	305,620	110,887	186,601	327,488	96,070	102,010	258,002
1930-31	..	410,848	305,620	138,609	135,362	271,031	90,486	80,401	170,887
Average	..	410,848	305,620	127,918	101,933	289,851	91,080	133,204	227,914

69.03% of col. 2.
73.20% of col. 3.

54.30% of col. 2.
57.61% of col. 3.

APPENDIX E-III.

DETAILS OF EXISTING REVENUE AND INCREASED COST OF ADMINISTRATION AND RUNNING CANALS, DEDUCTED FROM THE FORECAST OF FUTURE REVENUE

Note, dated the 8th July 1935, by Mr. Kanwar Sain, I.S.E., Executive Engineer on Special Duty, Haveli project.

1. Existing Revenue:

Abiana and Land Revenue—

Sidhnai consolidated rates

Chenab Inundation canals left bank
(excluding Bilochwah)

..	{ Abiana	..	7,41,380
..	{ Land revenue	..	2,04,498
..		..	2,50,382

Chenab Inundation canals right bank
Ganesh, Karam and Taliri only

..	{ Abiana	..	49,100
..	{ Land revenue	..	51,000

Fixed assessment on wells in perennial
area only 7,500 @ 25/- each

..	Total	..	14,83,860
..	say	..	15.0 lacs.

2. Increased cost of Civil administration—

Add extra cost of Civil administration
taken as for Dipalpur canal

..	2.16 lacs
----	-----------

..	Total	..	17.16 lacs.
----	-------	----	-------------

3. Increased cost of maintenance and running canals:—

Yearly irrigation on Haveli project—

	Acres
Perennial	.. 513,000
Non-perennial	.. 452,000

..	Total	..	965,000
----	-------	----	---------

Overall rate for revenue expenditure 2/- per acre—

965,000 acres @ 2/- per acre	..	19,30,000
Add for Pakpattan Link 30 miles @ 400/- per mile	..	12,000
Add for Burna Branch Extension	..	14,000

..	Total	..	19,56,000
----	-------	----	-----------

Deduct present cost of
revenue expenditure on
canals in Haveli tract—

Sidhnai (average of 5 years
1928-29 to 1932-33).

Maintenance and Repairs	..	75,493
Extensions and Improvements	..	4,480
Establishment	..	51,471

..	1,31,444
----	----------

Chenab Inundation canals (excluding Bilochwah)

(average of 5 years 1928-29 to 1932-33)—

Maintenance and Repairs	..	1,12,266
Extensions and Improvements	..	5,501
Establishment	..	73,425

..	1,91,192
----	----------

Ganesh, Karam, and Taliri (average of 5 years 1928-29 to
1932-33).

Maintenance and Repairs and Extensions and Improvements	..	68,652
Establishment	..	48,753

..	1,17,405
----	----------

Grand Total	4,40,041
say	4,40,000

Increased maintenance cost=Rs. 19.56-4.40=15.16 lacs.

4. Total amount to be deducted from future revenue:—

Existing revenue including fixed well assessment in the perennial area			Rs.
..	..	..	15.00 lacs.
Increased cost of civil administration	..	..	2.16 „
Increased cost of running canals	..	..	15.16 „
Total			32.32 „

To cover small differences a sum of Rs. 33 lacs is proposed to be deducted from the future revenue.

KANWAR SAIN—8-7-1935,

Ex. Engineer on Special Duty.

Forwarded for approval.

J. D. H. BEDFORD—8-7-35,

Chief Engineer, Construction.

To S. S., F. C. D.

Note, dated the 13th August 1935, by Mr. H. D. Bhanot, I.C.S., Senior Secretary to Financial Commissioner, Development.

This case relates to the amount to be deducted from the financial forecast of the project on account of existing revenue and the additional cost of Civil administration. The Irrigation Branch have calculated these two items amounting to:—

(1) Existing revenue .. Rs. 15 lacs.

(2) Additional cost of Civil administration Rs. 2.16 „

The additional cost of Civil administration has been assumed at the same figure as for Dipalpur canal in the Sutlej Valley project. These figures have been sent to us for the verification of the amounts shown against these two items.

2. Existing revenue.

Officer on Special Duty (Revenue) in his note,* dated the 10th August 1935, has calculated the existing revenue at Rs. 15.59 lacs compared with Rs. 15 lacs arrived at by Irrigation Branch. In Officer on Special Duty, Revenue's report on the revenue estimate of the project the existing income has been calculated as follows:—

(1) On area to receive perennial irrigation.

		Land revenue	Abiana.	Total.
		Rs.	Rs.	Rs.
Proprietary (a)	..	5,17,954	4,01,206	9,19,160
Crown waste (b)	..	19,996	2,582	22,578
Total		5,37,950	4,03,788	9,41,738

(a) Includes Rs. 1,01,516 on account of fixed land revenue.

(b) Includes Rs. 8,632/- income from forests and Rs. 3,919/- income from Tirni total Rs. 12,551.

(2) On area to receive non-perennial irrigation.

		Land revenue.	Abiana.	Total.
		Rs.	Rs.	Rs.
Proprietary (a)	..	6,87,788	2,25,508	9,13,296
Crown waste (b)	..	6,685	1,049	7,834
Total		6,94,473	2,25,657	9,21,130

(a) Includes Rs. 2,70,415 on account of fixed land revenue.

(b) Includes Rs. 1,911 income from forests and Rs. 2,000 income from Tirni total Rs. 3,911/-.

3. The total for perennial and non-perennial comes to Rs. 18,62,868. From this is to be deducted Rs. 3,71,931 on account of fixed assessment which will not change. The balance, which is to be deducted from the financial forecast, thus amounts to Rs. 14,90,937.

If the lump sum assessment on wells in the perennial area is to be abolished there will be a further deduction of Rs. 98,546, giving a total of Rs. 15,89,483 compared with Rs. 15.59 lacs given in Officer on Special Duty, Revenue's note,* dated the 10th August 1935. The reason for this discrepancy is that he has not included existing income from Crown waste area which amounts to Rs. 30,412.

*Not printed.

APP. E-III

4. The net result is that the amount to be deducted from the financial forecast on account of existing revenue is:—

- (1) Rs. 14.90 lacs or Rs. 15 lacs if the lump sum assessment on wells in the perennial area is not to be abolished, or
- (2) Rs. 15.89 lacs, if the lump sum assessment on wells in the perennial area is abolished.

5. The cost of extra Civil administration has been estimated at Rs. 2.16 lacs by Irrigation Branch, which is based on the debit raised on Dipalpur canal in the Sutlej Valley project. In my opinion this is excessive for the Haveli project.

6. In the Sutlej Valley project a total sum of Rs. 6,07,860 was calculated for raising a debit against the Irrigation Branch. Colonization Officer, Nili Bar, could not split this sum by canal units. Chief Engineer, Irrigation Branch, decided to distribute the total sum between Dipalpur, Pakpattan and Mailai canals in proportion to the areas commanded by each canal. Rs. 2.16 lacs came to the share of Dipalpur canal. The system of raising indirect debits against the Irrigation Branch on the Haveli project will be the same as in the Sutlej Valley project and is explained in Junior Secretary's letter* dated the 8th April 1929. We have to take into consideration:—

- (1) The additional expenditure incurred by Government on the district staff including Judicial, Revenue, Police and Colonization Departments.
- (2) The land revenue, which might be expected to have been obtained, had the canal not been made.
- (3) The difference between grazing dues received previous to the construction of the canal and now.
- (4) The cost of the *patwari* and *kanungo* agency employed in the canal-irrigated area, due allowance being made for the cost of the establishment which was maintained prior to the construction of the canal.
- (5) Additional expenditure incurred on *zaildari* and *sufaidposhi inams*.
- (6) $7\frac{1}{2}$ per cent. of the cost of new unremunerative buildings necessitated by the extra establishment under (1) above.

7. Total Crown waste area on the Haveli project is 108,761 acres, out of which 20,693 acres are inferior to be tried on temporary cultivation, compared with 119,669 acres on Dipalpur canal. Therefore, so far as these areas are concerned, Irrigation Branch may be right in taking for the Haveli project the same amount as calculated for the Dipalpur canal on account of the extra cost of Civil administration.

8. I have discussed the case with Officer on Special Duty, Revenue, who has local knowledge of the tract.

He is of opinion that there will not be any increase in the district revenue and judicial staff. One additional police station will most probably be needed in the Multan district.

We have already taken into consideration separately the existing income from land revenue, *abiana* and grazing dues. There will be some additional cost on the *patwari* and *kanungo* agency.

Colonization staff will have to be provided for. There will be slight expenditure on *zaildari* and *sufaidposhi inams*.

There will be a new building for one police station and possibly a *sarai* in the new proposed *mandi*. If the colonization staff is located at Multan or Khanewal, new buildings will not most probably be required.

Thus the additional expenditure on account of Civil administration will be:—

- (1) One police station in the Multan district.
- (2) Some extra *patwari* and *kanungo* establishment.
- (3) Colonization staff in charge most probably of an Extra Assistant Commissioner.
- (4) Slight increase in *zaildari* and *sufaidposhi inams*.
- (5) $7\frac{1}{2}$ per cent. on a new police station building and possibly a *sarai*.

In 2.16 lacs assumed for Dipalpur canal, land revenue is included. For the Haveli project it has been estimated separately. I would, therefore, put the additional cost of Civil administration for the Haveli project at Rs. 1.25 lacs. This is only a rough estimate. Correct credits and debits will be worked out later after the completion of the project.

*Not printed.

APP. E-III

9. Before the case goes further, Chief Engineer (Construction), Irrigation Branch, may be asked un-officially whether he agrees to—

(1) deduction of existing revenue as in paragraph 3 above ;

(2) deduction of 1.25 lacs on account of the extra cost of Civil administration.

To F. C. D.

H. D. BHANOT—13-8-35.

S.S., F. C. D.

I agree.

To S. S., F. C. D.

B. H. DOBSON—14-8-35.

F. C. D.

To C. E. (C).

H. D. BHANOT—14-8-35.

S.S., F. C. D.

1. The figure of Rs. 15.0 lacs given by Irrigation Branch did not include the land revenue raised on the *sailab*, *chahi* and *barani* areas, as it was considered these areas may not undergo any appreciable change after the Haveli project is constructed.

2. The deductions on account of existing land revenue and water-rates, abolition of the fixed well assessment in the perennial area and extra cost of Civil administration, as proposed by Irrigation Branch amounted to Rs. 17.16 lacs.

3. The total deductions on account of these very items as proposed by Senior Secretary, Financial Commissioner, Development, come to Rs. 15.89+Rs. 1.25 equal to Rs. 17.14 lacs. This is close enough to Rs. 17.16 lacs proposed by Irrigation Branch.

4. Irrigation Branch has no objection to the amount of deductions proposed in para. 9 above of Senior Secretary to Financial Commissioner, Development's note dated the 13th August 1935.

KANWAR SAIN—16-8-35,

Executive Engineer on Special Duty, Haveli Project.

To S. S., F. C. D.

Hon'ble Member, Revenue, might see.

H. D. BHANOT—16-8-35,

S. S., F. C. D.

B. H. DOBSON—17-8-35,

F. C. D.

MUZAFFAR KHAN—23-8-35,

H. M. R.

(Received from S.S., F. C. D. with U. O. No. 439 C. (S) dated 29th August 1935.)

Final Orders re. Deductions from Gross Revenue.

Cost of Civil administration and existing revenue	Rs.
including fixed well assessment in perennial area	= 17.14 lacs.
Cost of running new canals	= 19.56 „

	Total	36.70 „
Deduct cost of running existing canals		4.40 „
		32.30 „

Deduct 33 lacs to cover any small differences.

KANWAR SAIN—5-9-35,

Executive Engineer on Special Duty, Haveli Project.

APPENDIX E-IV.

PROBABLE REVENUE FROM THE HAVELI CANALS.

Detailed orders of the Government regarding all items, which form the basis of the financial forecast of the probable revenue from the Haveli canals, are given in the preceding three Appendices, E-I, E-II, and E-III. The statements in this Appendix are based on these orders. Necessary explanatory notes have been given at the bottom of each statement.

Statement I gives in an abstract form, the orders of the Government regarding disposal of the Crown waste land, contained in Senior Secretary to Financial Commissioner, Development's note, dated the 6th July, 1935 (Appendix E-I).

Statement II is prepared in the light of the experience in the Nili Bar colony. The sale of Crown waste land has been assumed at the rate of 2,000 acres per annum after all the canals are opened for irrigation.

Statement III shows the receipts from composite water-rates as approved by the Government both for the perennial and non-perennial areas, *vid.* Appendix E-II. The development of irrigation has been taken as a varying and gradually increasing percentage of the total Crown waste area, made available each year for cultivation. As will be seen from column 2 of this statement, the assumed development of irrigation is reasonably slow. *Kharaba* has been allowed for by making a deduction of 7 per cent. from the perennial and 10 per cent. from the non-perennial areas of irrigation.

Statement IV gives the indirect receipts from the Crown waste areas. Rates of sale of Crown waste lands and of temporary cultivation and *malikana* from peasant grantees have been taken from Financial Commissioner, Development's note*, dated the 8th July, 1935, given in Appendix E-I. Land revenue rates for the perennial and non-perennial Crown waste lands are taken from para. 13† of His Excellency, the Governor's note, dated the 2nd September, 1935, given in Appendix E-II. Interest has been calculated at the rate of 6 per cent. on the proceeds of land sold in the previous years plus 6 per cent. for 3 months only on the proceeds of land sold in the current year. Interest on the current year's proceeds has been taken only for 3 months, instead of 6 months usually allowed, as sales do not take place in January, but rather in March and October and money is not paid in till the middle of the year and the end of the year. This provides an additional small factor of safety.

Statement V gives the receipts from composite water-rates, as approved by the Government and given in Appendix E-II. The probable areas of irrigation in the first and the tenth year are taken from Mr. Bedford's note‡, dated the 2nd July, 1935 (Appendix D-I). On the non-perennial canals, the areas of probable irrigation in the first and the tenth year are as 258,000 and 452,000 acres, which give an intensity of 37 per cent. and 65 per cent. on the total culturable commanded area. The percentages assumed for the intermediate 8 years are 40, 43, 46, 49, 52, 55, 58 and 61.

On the perennial areas, the development of irrigation is expected to be fairly rapid, as most of the area is already well developed. In the first year of the opening of the canals, the expected area of irrigation has been intentionally kept at a low figure of 330,000 acres, which gives an intensity of 59 per cent. on the culturable commanded area.

The figure of 434,000 acres as given for the first year in Appendix D-I, has been taken for the second year, to be on the safer side; this gives an intensity of 78 per cent. The area of irrigation in the tenth year after the opening of the canals for irrigation, is expected to be 513,000 acres, giving an intensity of 89.4 per cent. Intensities for the intermediate 7 years have been assumed as 80, 81, 83, 84, 86, 87 and 88 per cent. of the culturable commanded area.

A deduction of 6 per cent. from perennial areas and 10 per cent. from non-perennial areas has been made from areas of irrigation on account of probable *kharaba*.

Statement VI shows the indirect receipts from the Crown waste areas, based on the approved composite rates, given in Appendix E-II.

Figures of direct and indirect revenue from the Haveli canals, as given in Statement VII, are carried over to columns 11 and 12 of Financial Statement III, Volume I.

* Page 108.

† Page 133.

‡ Page 91.

APPENDIX E-IV, STATEMENT I.

HAVELI CANALS

STATEMENT GIVING THE DETAILS OF DISTRIBUTION OF CROWN WASTE LAND.

(SENIOR SECRETARY TO FINANCIAL COMMISSIONER DEVELOPMENT'S L. O. 263-C(S) DATED 19-7-35.)

PERENNIAL (GOOD LANDS).					PERENNIAL (INFERIOR LANDS).	NON-PERENNIAL.
Sales to capitalists.	Land in exchange as compensation.	Grants on peasant terms.	Free grants or departmental reservations.	Mandis & factories.	Temporary cultivation.	Grants on peasant terms.
1	2	3	4	5	6	7
Acres.	Acres.	Acres.		Acres.	Acres.	Acres.
Total areas.		Peasant grants.				
Gross = 34,000	Gross = 2,265	Gross = 31,734	Nil	Gross = 800	Gross = 22,992	Gross = 20,689
Net = 31,980	Net = 2,038	Net = 29,579			Net = 20,993	Net = 18,620
		Tahud-Lahals.				
		Gross = 6,078				
		Net = 6,071				
	Gross area available for allotment after deducting 5% for roads, canals, etc.	Acres.				
		= 75,407			22,992	20,689
	Net area to be allotted	= 69,118			20,693	18,620
	Total area	= 79,171			22,992	21,777

Total good land = 101,218 acres.
Total inferior land = 31,905 "
Total bad land = 99,303 "

Grand total = 210,640 "
Note :- Areas in this statement are as approved vide Appendix E-I.

APPENDIX E-IV, STATEMENT II.
HAVELI CANALS
SALES AND GRANTS OF CROWN WASTE AREAS.

Up to the end of	PERMANENT							NON-PERMANENT CROWN WASTE COLONIZED.	
	Sales.	Land in exchange.	Grants on peasant terms.	Free grants for farms.	Mandi.	Temporary leases (good lands.)	Temporary leases (inferior lands.)	Total available for irrigation.	Peasant grants.
1	2	3	4	5	6	7	8	9	10
6th year	Acres	Acres	Acres	..	800 acres included in temporary cultivation.	..	Acres	Acres	Acres
7th "	..	1,000	2,000	..		2,000+800	..	4,000	..
8th "	2,000	1,500	6,000	..		4,000+800	2,000	14,300	1,000
9th "	4,000	1,700	9,000	..		8,000+800	4,000	23,500	2,000
10th "	6,000	2,000	12,000	..		12,000+800	6,000	34,800	6,000
11th "	8,000	2,038	16,000	..		16,000+800	8,000	46,838	8,000
12th "	10,000	2,038	20,000	..		20,000+800	10,000	58,838	10,000
13th "	12,000	2,038	24,000	..		24,000+800	12,000	68,838	12,000
14th "	14,000	2,038	28,000	..		28,000+800	14,000	75,338	14,000
15th "	16,000	2,038	32,000	..		32,000+800	16,000	81,338	16,000
16th "	18,000	2,038	34,650	..		34,650+800	18,000	85,988	18,020

900 acres have been allowed for a mandi but credits at high prices has not been taken, because it is not clear when the mandi will be required; so for forecast it is taken as on temporary cultivation.
Area in mandi is included in column 7 because water has to be supplied to mandi.
Column 7. Area of good land available for temporary leases in the 16th year is 13,900 but only 12,500 acres have been taken in the forecast.
Column 8. Not area of inferior land for temporary leases is 20,693 acres vide statement I, but we must assume that total area will not be leased and 10% will always be left over. Only 18,000 acres have, therefore, been taken in the forecast.
Column 9, is obtained by adding column 2 to 8.
Column 10. 18,020 acres is obtained from statement I.

APPENDIX E-IV, STATEMENT III
HAVELI CANALS
STATEMENT SHOWING DIRECT RECEIPTS FOR CROWN WASTE AREAS, ONLY.

Yr.	PERENNIAL.				NON-PERENNIAL.				Perennial and non-perennial total direct receipts.
	Annual area irrigated.	Annual area assessed.	Composite abiana rate per acre.	Direct receipts.	Annual area irrigated.	Annual area assessed.	Composite rate per acre.	Revenue from abiana.	
	2	3	4	5	6	7	8	9	10
	Acre.	Acre.	Rs.	Rs.	Acre.	Acre.	Rs.	Rs.	Rs.
6th	2,360	2,193	3-86	8,473	..	..	3-15	..	8,473
7th	11,154	10,373	3-86	40,010	400	360	3-15	1,134	41,174
8th	18,800	17,484	3-86	67,188	800	774	3-15	2,438	69,926
9th	28,188	26,215	3-86	1,01,190	2,780	2,481	3-15	7,825	1,09,015
10th	38,876	36,133	3-86	1,39,538	3,920	3,528	3-15	11,113	1,50,671
11th	40,424	45,961	3-86	1,77,421	5,200	4,680	3-15	14,742	1,92,163
12th	59,201	55,057	3-86	2,12,520	6,600	5,940	3-15	18,711	2,31,231
13th	65,544	60,956	3-86	2,35,200	8,120	7,308	3-15	23,020	2,58,310
14th	71,577	66,507	3-86	2,56,040	9,760	8,784	3-15	27,670	2,84,619
15th	70,873	71,102	3-86	2,75,950	11,700	10,530	3-15	33,170	3,09,129

Col. 2 is obtained as a varying and increasing percentage of irrigation *vide* 1st year 80-2nd year 78. succeeding years 80, 81, 83, 84, 86, 87, 88 and 89-4 on total area available for irrigation, *vide* col. 9, statement II. The final percentage of irrigation obtained in the 13th year is 89-4, *vide* Statement VIII, Appendix D-I, page 99.

Col. 3 is obtained by deducting 7% *khara* from col. 2.

Col. 4 is the composite *abiana* rate as finally approved, *vide* Appendix E-II, page 133.

Col. 5 is col. 3 x col. 4.

Col. 6 is obtained as a varying and increasing percentage of irrigation on total area available for irrigation, *vide* col. 10, Statement II.

Col. 7 is col. 6 less 10% for *khara*.

Col. 8 is obtained from Appendix E-II, page 133.

APPENDIX E-IV, STATEMENT IV.

HAVELI CANALS.

STATEMENT SHOWING INDIRECT RECEIPTS (CROWN WASTE AREA.)

Year.	PERMANENT.										NON-PERMANENT.														
	Total annual assessed irrigation.	Land revenue rate per acre.	Land revenue on assessed area.	Good land.			Area for sale to capitalists up to the end of the year.	Rate per acre.	Capital value of Crown waste areas.	Interest @ 6%.	Decennial grants.	Mulkiana rate per acre.	Revenue from malkiana.	Inferior land.			Total indirect receipts.	Annual total assessed irrigation.	Land revenue rate per acre.	Land revenue.	Decennial grants.	Mulkiana rate per acre.	Revenue from malkiana.	Total indirect receipts.	Total indirect receipts from Crown waste permanent and non-permanent.
				Area of temporary lease.	Rent from temporary lease.	Rent per acre.								Area of temporary lease.	Rent from temporary lease.	Rent per acre.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Rs.	Acres.	Rs.	Rs.	Acres.	Rs.	Rs.	Acres.	Rs.	Rs.	Rs.	Acres.	Rs.	Rs.	Acres.	Rs.	Rs.	Rs.	Acres.	Rs.	Rs.	Acres.	Rs.	Rs.	Rs.	Rs.
6th	2,103	3	0,585	..	8	..	..	250	..	..	3,000	2	0,000	..	3	..	12,585	..	1/8	..	..	..	..	..	12,585
7th	10,373	3	31,119	2000+800	8	22,100	2,000	250	5,00,000	7,500	0,000	2	12,000	2,000	3	0,000	70,010	360	1/8	510	1,000	1	1,000	1,540	80,550
8th	17,481	3	52,452	1000+800	8	38,100	4,000	250	10,00,000	37,500	0,000	2	18,000	4,000	3	12,000	1,59,352	774	1/8	1,161	2,000	1	2,000	3,161	1,61,513
9th	24,215	3	78,615	8000+300	8	70,100	6,000	250	13,00,000	67,500	12,000	2	21,000	6,000	3	18,000	2,53,515	2,484	1/8	3,720	6,000	1	6,000	9,720	2,08,271
10th	36,157	3	1,08,465	12000+800	8	1,02,100	8,000	250	20,00,000	97,500	10,000	2	32,000	8,000	3	24,000	3,64,365	3,528	1/8	5,292	9,000	1	8,000	13,292	3,77,657
11th	43,964	3	1,37,892	16000+800	8	1,31,100	10,000	250	25,00,000	1,27,500	20,000	2	40,000	10,000	3	30,000	4,69,792	4,080	1/8	7,020	10,000	1	10,000	17,020	4,80,812
12th	55,037	3	1,65,171	18000+800	8	1,50,100	12,000	250	30,00,000	1,57,500	21,000	2	48,000	12,000	3	30,000	5,57,071	5,040	1/8	8,910	12,000	1	12,000	20,910	5,77,981
13th	60,930	3	1,82,868	10500+800	8	1,38,100	11,000	250	35,00,000	1,87,500	28,000	2	50,000	14,000	3	42,000	6,06,768	7,308	1/8	10,962	14,000	1	14,000	24,962	6,31,750
14th	66,567	3	1,99,701	11500+800	8	1,22,100	10,000	250	40,00,000	2,17,500	32,000	2	64,000	16,000	3	48,000	6,51,001	8,784	1/8	13,176	16,000	1	16,000	29,176	6,80,777
15th	71,492	3	2,14,476	12500+800	8	1,04,100	18,000	250	45,00,000	2,47,500	34,630	2	69,300	18,000	3	51,000	6,91,676	10,530	1/8	15,795	18,620	1	18,620	34,415	7,26,091

Column 2 is taken from column 3 of Statement III.

Column 3 is taken from column 3 of Statement III.

Column 4 is taken from column 3 of Statement III.

Column 5 is taken from column 3 of Statement III.

Column 6 is taken from column 3 of Statement III.

Column 7 is taken from column 3 of Statement III.

Column 8 is taken from column 3 of Statement III.

Column 9 is taken from column 3 of Statement III.

Column 10 is taken from column 3 of Statement III.

Column 11 is taken from column 3 of Statement III.

Column 12 is taken from column 3 of Statement III.

Column 13 is taken from column 3 of Statement III.

Column 15 is obtained from column 8, Statement II.

Column 16 is obtained from column 8, Statement II.

Column 17 is obtained from column 8, Statement II.

Column 18 is obtained from column 8, Statement II.

Column 19 is obtained from column 8, Statement II.

Column 20 is obtained from column 8, Statement II.

Column 21 is obtained from column 8, Statement II.

Column 22 is obtained from column 8, Statement II.

Column 23 is obtained from column 8, Statement II.

Column 24 is obtained from column 8, Statement II.

Column 25 is obtained from column 8, Statement II.

Column 26 is obtained from column 8, Statement II.

APPENDIX E-IV, STATEMENT V.

HAVELI CANALS.

STATEMENT SHOWING DIRECT RECEIPTS (PROPRIETARY AREAS.)

YEAR.	AREA IRRIGATED.		AREA ASSESSED.		Composite abiana rate per perennial acre.	Composite abiana rate per non-perennial acre.	Abiana perennial.	Abiana non-perennial.	Total abiana.
	Perennial.	Non-perennial.	Perennial.	Non-perennial.					
1	2	3	4	5	6	7	8	9	10
	Acrea.	Acrea.	Acrea.	Acrea.	Rs.	Rs.	Rs.	Rs.	Rs.
6th ..	336,426	258,000	316,240	232,200	3-86	3-15	12,20,086	7,31,430	19,52,116
7th ...	436,732	279,200	410,528	251,280	3-86	3-15	15,81,038	7,01,532	23,76,170
8th ..	440,670	299,700	414,136	269,730	3-86	3-15	15,08,565	8,40,650	24,49,215
9th ..	436,925	318,700	410,710	286,830	3-86	3-15	15,85,341	9,03,515	24,88,856
10th ..	437,721	338,500	411,458	301,650	3-86	3-15	15,88,228	9,59,048	25,47,876
11th ..	432,915	358,000	406,080	322,200	3-86	3-15	15,70,943	10,14,030	25,85,873
12th ..	434,622	378,000	408,545	340,200	3-86	3-15	15,76,984	10,71,630	26,48,614
13th ..	434,021	397,000	407,980	357,300	3-86	3-15	15,74,803	11,25,405	27,00,208
14th ..	433,730	416,500	407,706	374,850	3-86	3-15	15,73,745	11,80,778	27,54,523
15th ..	436,473	440,300	410,285	396,270	3-86	3-15	15,83,700	12,48,251	28,31,951

Perennial *khara* deducted at 6% from perennial area, as most of the area is established existing area. *Khara* deducted at 10% from non-perennial area.

Non-perennial irrigation; 1st year 258,000—Final year 452,000 as per page 91. Total C. C. A. 698,801 Statement VIII Appendix D-I (including Crown waste). 1st year's intensity 37% : subsequently 40, 43, 46, 49, 52, 55, 58, 61 and 65%.

Perennial proposed total irrigation; 1st year, 330,000 acres—2nd year 434,000 acres. Final year—613,000 acres (page 91). Mean intensity 50, 78, 80, 81, 83, 84, 86, 87, 88, 89-4% on a total of 574,213 culturable commanded area as per Statement VIII, Appendix D-I.

The areas for proposed perennial irrigation are at present moderately well developed, hence ready to absorb increased supplies.

Column 2 is obtained by taking percentages given above on total C. C. A. and deducting actual figures of irrigation in Crown waste areas given in column 2, Statement III.

Column 3 do. do. do. Column 6, Statement III (Crown waste).

Columns 6 & 7 are as approved, vide Appendix E-II, page 133.

In considering this statement it must be remembered that the figures of proposed irrigation have not been obtained by assuming varying percentages on culturable area. The beginning was the water. From the water we got the areas that can be irrigated by the water. This area is fixed and does not depend on assumed culturable areas. The percentages of culturable area shown are mainly derivatives as a convenience in showing development of irrigation. We intend to take in all areas that can be commanded as perennial and non-perennial. The culturable area is only of importance in showing that we have sufficient area on which to spread the water. The Irrigation Branch figures of culturable area are less than the Civil due to exclusion of *Sitab* land, etc., but if we find that such land can be irrigated and the owners desire irrigation, we will irrigate it and spread the water over the bigger area, but this will not increase the irrigation or the revenue receipts.

APPENDIX E-IV, STATEMENT VI.
HAVELI CANALS.

STATEMENT SHOWING INDIRECT RECEIPTS (PROPRIETARY AREAS.)

YEAR.	Perennial assessed area.	Land revenue rate per acre.	Land revenue from perennial.	Non-peren- nial assess- ed area.	Composite land revenue rate per acre.	Land revenue non-peren- nial.	Total land revenue.
1	2	3	4	5	6	7	8
	Acres.	Rs.	Rs.	Acres.	Rs. a. p.	Rs.	Rs.
6th ..	316,240	2-15	679,916	232,200	1 14 0	4,25,375	11,15,291
7th ..	410,528	2-15	882,635	251,280	1 14 0	4,71,150	13,53,785
8th ..	414,136	2-15	890,392	269,730	1 14 0	5,05,744	13,96,136
9th ..	410,710	2-15	883,027	286,830	1 14 0	5,37,806	14,20,832
10th ..	411,458	2-15	884,635	304,650	1 14 0	5,71,219	14,55,854
11th ..	406,980	2-15	875,007	322,200	1 14 0	6,04,125	14,79,132
12th ..	408,545	2-15	878,372	340,200	1 14 0	6,37,875	15,16,247
13th ..	407,980	2-15	877,157	357,300	1 14 0	6,69,038	15,47,095
14th ..	407,706	2-15	876,568	374,850	1 14 0	7,02,844	15,79,412
15th ..	410,285	2-15	882,113	399,270	1 14 0	7,43,006	16,25,119

Col. 2 obtained from col. 4, Statement V.
Col. 5 obtained from col. 5, Statement V.
Col. 3 as approved, vide Appendix E-II, page 134.
Col. 6 as per Statement VI to Appendix E-II.

APPENDIX E-IV, STATEMENT VII.
HAVELI CANALS.

STATEMENT SHOWING DEVELOPMENT OF IRRIGATION AND GROSS REVENUE.

YEAR.	AREA ASSESSED.				Total area assessed.	DIRECT RECEIPTS.		INDIRECT RECEIPTS.		Gross revenue.
	Perennial.		Non-perennial.			Crown waste perennial and non-perennial.	Proprietary perennial and non-perennial.	Crown waste perennial and non-perennial.	Proprietary perennial and non-perennial.	
	Crown waste.	Proprietary.	Crown waste.	Proprietary.						
1	2	3	4	5	6	7	8	9	10	11
6th ..	Acres. 2,195	Acres 316,240	Acres. ..	Acres. 232,200	Acres. 550,635	Rs. 8,473	Rs. 19,52,116	Rs. 12,685	Rs. 11,15,291	Rs. 30,88,465
7th ..	10,373	410,528	360	251,280	672,541	41,174	23,76,170	80,550	13,53,785	38,51,688
8th ..	17,484	414,136	774	269,730	702,124	69,926	24,48,215	1,61,513	13,96,136	40,75,790
9th ..	26,215	410,710	2,484	286,830	729,239	109,015	24,88,855	2,68,271	14,20,832	42,86,974
10th ..	30,155	411,458	3,528	304,650	735,791	150,071	25,47,876	3,77,657	14,55,854	45,32,058
11th ..	45,964	406,980	4,080	322,200	779,824	192,163	25,85,873	4,86,812	14,79,132	47,43,980
12th ..	55,057	408,545	5,940	340,200	809,742	231,231	26,48,614	5,77,981	15,10,247	49,74,073
13th ..	60,956	407,980	7,308	357,300	833,544	258,310	27,00,298	6,31,730	15,47,095	51,37,433
14th ..	66,567	407,706	8,784	374,850	857,907	284,019	27,54,523	6,80,777	15,70,412	52,99,331
15th ..	71,492	410,285	10,530	396,270	888,577	309,129	28,31,951	7,26,091	16,25,119	54,92,290

Col. 2 is obtained from col. 3, Statement III.
Col. 3 do. do. 4 do. V.
Col. 4 do. do. 7 do. III.
Col. 5 do. do. 5 do. V.
Col. 6 sum of columns 2 to 5.
Col. 7 is obtained from col. 10, Statement III.
Col. 8 do. do. 10 do. V.
Col. 9 do. do. 26 do. IV.
Col. 10 do. do. 8 do. VI.

APPENDIX E-V.

PROBABLE REVENUE FROM THE MONTGOMERY-PAKPATTAN LINK.

Note, dated the 1st July 1935, by Mr. J. D. H. Bedford, Chief Engineer,
Construction Administration, Irrigation Works, Punjab.

The total increase in irrigation, as shown in Appendix D-II,* will probably be 1,28,400 acres. In the forecast the average water and land revenue rates, as accepted in the Sutlej Valley Project Completion Report, 1935, pages 128 and 154, may be accepted to give the receipts from water-rates and land revenue for this increased area of irrigation.

2. The net Crown waste area, as per page 123 of the Completion Report, 1935, of the Sutlej Valley project, is as follows:—

Land reserved for exchange	..	..	20,000 acres.
Sale to capitalists	..	..	329,722 "
Grant on peasant terms	..	..	302,049 "
Areas for special reservation	..	..	18,958 "
Factories	..	..	3,700 "
Total			.. = 674,429 "

Maximum irrigation probable under the Sutlej Valley project with intensity of irrigation as 60% = 402,000 acres.

Add 128,000 acres of new irrigation.

Total = 530,000 acres.

New intensity will be 80 per cent. which represents one-third increase in annual irrigation. The present reserve price for land is Rs. 250 per acre. This increased water supply will make the land more popular than the increased percentage of irrigation would imply, but for purposes of the forecast we may accept 30 per cent. increase in the sale value of land, i.e., the Haveli may take a credit of Rs. 75 per acre. It is not proposed to take any increase in value of land devoted to peasant grants, etc. The increase of Rs. 75 per acre is suggested on land still available for sale to capitalists only.

Rs. 50/- per acre
approved by F.C.D.
J.D.H. BEDFORD.
25-7-35.

Reference is invited to page 130 of the Sutlej Valley Project Completion Report 1935, column 9, year 1949-50. Total area shown available for irrigation is 629,507 acres as against a net area available of 674,429 minus 4,480 or 669,949 acres.

3. The above cautious forecast was fully justified under conditions of water supply then prevailing, but, with the very appreciable increase of water, it will not be unreasonable to assume, that in 1949-50 we shall get the whole of 669,949 acres available for irrigation. The proposed forecast is shown in Statement I† and is a modification of the statement on page 130 of the Sutlej Valley Project Completion Report 1935.

This increase was
not accepted by
Financial Commis-
sioner, Development,
and the total area
available for irriga-
tion was reduced to
633,987 acres vide
Statement III, page
158.

4. An increased rate of Rs. 3 per acre for temporary cultivation is suggested. This will make a total rate of Rs. 9 per acre for temporary cultivation and in view of the large increased popularity of leases on account of increased water supply, this Rs. 3 per acre is probably not excessive. In the calculations of increased percentage of irrigation (para. 2) we have assumed 60 per cent. yearly irrigation under present conditions for the Pakpattan canal. The actual figures, however, are only 50 per cent. on allotted areas. In the year 1932-33 the actual irrigation was about 251,000 acres on the Crown waste area, and an increase of 128,000 acres on this represents a 50 per cent. increase. Hence, this proposed additional rate of Rs. 3 per acre for temporary leases is not really excessive.

Rs. 2/- per acre
approved by F.C.D.
J.D.H. BEDFORD.
25-7-35.

5. Approval is, therefore, requested to the forecast shown in Statement I, and to allowing a credit of Rs. 75 per acre, to the Haveli on the Pakpattan perennial areas reserved for capitalists and as yet unsold, and also to allowing Rs. 3 per acre as additional temporary lease rent: also to using the figures for water-rate and land revenue, as given on pages 128 and 154 of the Sutlej Valley Project Completion Report for purposes of this forecast.

These water-rates
and land revenue
rates approved by
F.C.D.
J.D.H. BEDFORD.
25-7-35.

J. D. H. BEDFORD—1-7-35,
Chief Engineer, Construction.

To S. S., F. C. D.

Note, dated the 6th July 1935, by Mr. H. D. Bhanot, I.C.S., Senior Secretary
to Financial Commissioner, Development.

The irrigation intensity of the perennial area on the Pakpattan canal was 51 per cent. It was subsequently raised to 60 per cent. of the culturable commanded area. In the Completion Report of the Sutlej Valley project, it was assumed, that land, getting perennial irrigation from the Pakpattan canal in the Nili Bar colony, would sell at Rs. 250 per acre on the average, and the rent for temporary cultivation would be Rs. 6 per allotted acre.

On paper only. The
water supply to canal
was not increased.
J.D.H. BEDFORD.
25-7-35.

2. Owing to the construction of the Haveli project there will be some water available at Balloki weir. It is proposed to construct a link between the Lower Bari Doab and the Pakpattan canals, and put this extra water into the Pakpattan canal. The Chief Engineer says, in the foregoing note, that this will raise the irrigation intensity of the perennial area in the Nili Bar colony from 60 per cent. to 80 per cent. He is of opinion that owing to this increase¹ of 20 per cent. in the irrigation intensity, there will be a 30 per cent. increase in the price of perennial land in Nili Bar colony and in the rent for temporary cultivation. Thus he thinks that the perennial land in Nili Bar colony will sell for Rs. 325 per acre instead of Rs. 250 per acre and rent for temporary cultivation will be Rs. 9 per acre instead of Rs. 6 per acre. As this increase will be directly due to the construction of the Haveli project, the Chief Engineer proposes to credit to the Haveli project Rs. 75 per acre for the sale of land and Rs. 3 per acre for rent on temporary cultivation in the perennial area of Nili Bar colony.

3. The question for decision is whether a 20 per cent increase in irrigation intensity² will cause an increase in the price of land which is already getting 60 per cent. irrigation. Theoretically it should cause an increase; but I doubt if it will in practice. There have been seven auctions of agricultural land in the Nili Bar colony:—

No. of auction.	Date of auction.	Average price per acre.	Irrigation intensity.
I ..	December 1926	Rs. 484	Per cent. 51
II ..	March 1927	398	51
III ..	November 1927	398	51
IV ..	March 1928	424	51
V ..	November 1928	328	51
VI ..	March 1929	384	51
VII ..	March 1934	252	60

It will be seen that when irrigation intensity was 51 per cent., the average price ranged from Rs. 328 to Rs. 484 per acre. When irrigation intensity was raised to 60³ per cent., the average price was Rs. 252. Renala lift area is very good land and irrigation intensity in the Lower Bari Doab canal is 80 per cent. An auction sale of agricultural land held in April 1934 brought an average price of Rs. 306 per acre. I am of opinion that a rise of 20 per cent. in the irrigation intensity of land already receiving perennial irrigation will not influence very much its price. The price of land depends upon the price of agricultural produce and general agricultural prosperity, particularly when we demand 50 per cent. of the price immediately after the sale and balance in two equal annual instalments with 5 per cent. interest on unpaid balances. Those who buy land must have ready cash. In any case I do not see why the increase in land price should be assumed out of proportion⁴ to the increase in irrigation intensity. There will be 20 per cent. increase⁴ in irrigation intensity and the same increase may be assumed in the price of land, i.e., Rs. 50 and Rs. 250 per acre. Similarly rent for temporary cultivation may be raised from Rs. 6 to Rs. 8 per acre. Thus for financial forecast purposes the Haveli project may be given credit for Rs. 50 for every acre of perennial land sold in future in the Nili Bar colony and of Rs. 2 per acre for every acre of perennial land leased for temporary cultivation. In practice, however, the Haveli project should be credited with the actual excess over Rs. 250 per acre on land sold up to a maximum of Rs. 50 per acre. Similarly in the case of rent for temporary cultivation, the actual credit to be given to the Haveli project will be the excess over Rs. 6 per acre up to a maximum of Rs. 2 per acre. This I suggest because the finances of one project should not be further depleted by the construction of another canal project.

¹Actual irrigation intensity never has been 60 per cent. Drop in prices is due to depression and partly to disappointment due to short supplies.
J.D.H. BEDFORD.
25-7-35.

²If 60 acres out of 100 are being irrigated and then irrigation is increased to 80 acres the increase in area irrigated is 1/3 or 33 per cent.
J.D.H. BEDFORD.
25-7-35.

4. According to Chief Engineer, the probable increase in irrigation in the perennial area of the Nili Bar colony will be 128,400 acres owing to the increase in irrigation intensity from 60 per cent. to 80 per cent. It is to be decided what average water and land revenue rates should be adopted for this area. Obviously they should be the same as for the rest of the perennial area of the Nili Bar colony, i.e., those given at pages 128 and 154 of the Sutlej Valley Project Completion Report, 1935. This is what Chief Engineer suggests and may be approved.

5. Finally, the Statement I* forwarded by Chief Engineer is to be considered. The *Page 157. columns of this statement correspond to the columns of statement No. 3† of the Sutlej Valley †Page 130. Project Completion Report, 1933. The variations in figures are:—

(1) Column 3.

Chief Engineer's statement shows that by 1938-39‡, 17,275 acres will be sold and 127,275 acres by 1949-50§, whereas statement No. 3† of the Completion Report forecast that 37,275 acres would be sold by 1938-39 and 150,000 acres by 1949-50. The decrease in area is explained in a foot-note to the Chief Engineer's statement. Chief Engineer assumes that there will be no sales in the Nili Bar colony up to 1938-39. We may agree to the figures in column 3 of the Chief Engineer's statement.

(2) Columns 8 and 9.

These columns must be considered together. The total net perennial area available for allotment in the Sutlej Valley project or Nili Bar colony is 674,429 acres. Out of this, 4,480 acres have been reserved for *mandis*, vide column 7 of statement No. 3 of the Sutlej Valley Project Completion Report. The balance available for allotment is 669,949** acres. This area, Chief Engineer says, will be brought under irrigation by 1949-50, vide column 9 of his statement. Therefore, he proceeds to calculate that column 9 of his statement minus the total of columns 3, 4, 5, 6 and 7 will be the area to be leased for temporary cultivation. This was the method adopted in the Sutlej Valley project of 1926. It has been pointed out in explanation to column 8, on page 110 of the Sutlej Valley Project Completion Report, that this method does not give accurate results. Annexure A to statement No. 3, read with the explanation under column 8 at page 110 of the Sutlej Valley Project Completion Report will show how temporary cultivation area was calculated for the completion report and it is, in my opinion, likely to give accurate results. Chief Engineer's contention is that as irrigation intensity has increased, the entire area available should be leased out for temporary cultivation; but in practice this does not happen. Some areas cannot be leased for temporary cultivation, and it is not too much to presume that out of the total area of 674,429 acres, 40,442 will remain unallotted in 1949-50. **The proposal is that 669,949 acres will be available for irrigation, the actual yearly irrigation being about 80 per cent. of this area. J.D.H. BRADFORD, 25-7-35. †Page 111.

What has happened is that, compared with column 3 of statement No. 3 of the Sutlej Valley Project Completion Report, the area for sale has decreased in column 3 of the statement No. 1 attached.

The position for 1938-39 is as follows—

Column 3 of statement No. 3 of Sutlej Valley Project

Completion Report	..	..	37,275 acres.
Column 3 of Chief Engineer's statement I	..	..	17,275 ..
Decrease	..	..	20,000 ..

I would simply add this area of 20,000 acres to 210,000 acres shown under temporary cultivation in column 8 of Statement No. 3 of S. V. P. Completion Report, making it 230,000 instead of 225,520 acres shown by Chief Engineer in column 8 of his statement. Similarly, for 1949-50:—

Column 3 of Sutlej Valley Project Statement No. 3	..	..	150,000 acres.
Column 3 of Chief Engineer's statement I	..	..	127,275 ..
Decrease	..	..	22,725 ..

Add this to 140,000 acres under temporary cultivation in column 8 of Sutlej Valley project statement No. 3 and the result is 162,725 acres instead of 198,687 acres in column 8 of Chief Engineer's statement I. Corrected figures are shown in statement III¶, and these ¶Page 158. may be approved.

H. D. BHANOT—6-7-35,

S. S., F. C. D.

To F. C. D.

Note, dated the 9th July 1935, by Mr. B. H. Dobson, C.B.E., I.C.S., Financial Commissioner, Development.

This is another reference concerning the Haveli project estimates. The particular question is how much credit can be taken for improved irrigation in the Nili Bar due to the construction of Montgomery-Pakpattan Link. The Senior Secretary has with his usual care discussed all the details of the case and I have little to add.

It is quite true that statistics of intensity do not appeal much to prospective purchasers or even to actual cultivators. The latter use the water provided in their own way and the results very often differ considerably from the estimates of the Canal Department. What makes an irrigated tract valuable in the money market is really the general reputation it enjoys in the matter of soil and irrigation. So far the Nili Bar has not enjoyed a particularly good reputation, in the matter of irrigation at any rate. If, therefore, there is an increase in the supply of water through the construction of this linked canal, which is going to increase cultivation from 60 to 80 per cent, there is, I think, bound to be sooner or later a

†Corresponds to the 4th year in statement I, page 157.
§ " " 15th " " " "

APP. E-V

substantial increase in land values, presuming economic conditions are normal. But, I agree with Senior Secretary in not going as far as the Chief Engineer and concur in his proposal to credit any excess over Rs. 250 per acre on land sold up to a maximum of Rs. 50 per acre, and any excess over Rs. 6 per acre in the case of temporary cultivation up to a maximum of Rs. 2 per acre.

The water and land revenue rates to be applied to the increased irrigation will be the same as in the perennial area of Nili Bar colony, as indicated by the Senior Secretary. The remainder of the Senior Secretary's proposals may also be approved. I do not think His Excellency need see this case, as it is only a very provisional estimate.

B. H. DOBSON—9-7-35.
F. C. D.

To H. M. R.

Improved water conditions are sure to raise the prices, though to what extent it is difficult to estimate. I think His Excellency should see this case.

MUZAFFAR KHAN—15-7-35.
H. M. R.

H. W. EMERSON—16-7-35.
H. E.

(Received with U. O. No. 262-C(S), dated 19th July, 1935 from S. S., F. C. D.).

The statements showing forecast of revenue from the Montgomery-Pakpattan Link have been prepared in accordance with the above orders.

Statement II shows the Direct receipts. 8 per cent. *kharata* has been allowed for summer crops and 5 per cent. for winter crops.

Statement III shows how the Crown waste area is proposed to be dealt with. Columns 8 and 9 have been modified in accordance with para. 5(2) of the Senior Secretary's note, dated the 5th July, 1935.

Statement IV shows the Indirect receipts.

Statement V shows the gross revenue from this source.

KANWAR SAIN—25-7-35,
Executive Engineer on Special Duty.

APPENDIX E-V, STATEMENT I

MONTGOMERY—PAKPATTAN LINK.

SALES AND GRANTS OF CROWN WASTE ON THE PAKPATTAN PERENNIAL CANAL
AS PROPOSED BY IRRIGATION BRANCH.

YEAR.	Total Crown waste.	Sales to capitalists.	Land in exchange as compen- sation.	Grants on peasant terms.	Free grants for farms.	Mandis.	Temporary leases.	Total columns 3, 4, 5, 6, 7 & 8.
1	2	3	4	5	6	7	8	9
	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.
4th ..	863,371	17,275	18,500	302,049	18,958	4,480	225,520	586,782
5th ..	"	27,275	18,500	302,049	18,958	4,480	223,080	594,342
6th ..	"	37,275	18,500	302,049	18,958	4,480	220,640	601,902
7th ..	"	47,275	18,500	302,049	18,958	4,480	218,200	609,462
8th ..	"	57,275	18,500	302,049	18,958	4,480	215,760	617,022
9th ..	"	67,275	18,500	302,049	18,958	4,480	213,320	624,582
10th ..	"	77,275	18,500	302,049	18,958	4,480	210,880	632,142
11th ..	"	87,275	18,500	302,049	18,958	4,480	208,440	639,702
12th ..	"	97,275	18,500	302,049	18,958	4,480	206,000	647,262
13th ..	"	107,275	18,500	302,049	18,958	4,480	203,560	654,822
14th ..	"	117,275	18,500	302,049	18,958	4,480	201,120	662,382
15th ..	"	127,275	18,500	302,049	18,958	4,480	198,687	669,949

Column 3. The area taken here is that for 1934-35, sales of land having been stopped because of the expected increase in irrigation and future rise in prices. In the Sutlej Valley Project Completion Report, 1935, we have taken 10,000 acres sale per year from 1938-39 and it is not proposed to alter this.

APPENDIX E-V, STATEMENT II

MONTGOMERY—PAKPATTAN LINK.

STATEMENT SHOWING DIRECT RECEIPTS.

YEAR.	SUMMER CROPS.		WINTER CROPS.		Total assessed.	Water- rate for sum- mer crops per acre.	Water rate for winter crops per acre.	DIRECT RECEIPTS.		Total direct receipts.
	Area irrigated (From Appen- dix D-II)	Area assessed.	Area irrigated. (From Appen- dix D-II)	Area assessed.				Summer crops.	Winter crops.	
1	2	3	4	5	6	7	8	9	10	11
	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Rs.	Rs.	Rs.	Rs.	Rs.
4th ..	20,000	18,000	..	..	18,000	4.42	4.0	79,560	..	79,560
5th ..	40,000	36,000	..	..	36,000	4.42	4.0	1,59,120	..	1,59,120
6th ..	40,000	37,000	30,600	28,500	65,500	4.42	4.0	1,63,540	1,14,000	2,77,540
7th ..	50,000	46,000	50,600	47,560	93,560	4.42	4.0	2,03,320	1,90,000	3,93,320
8th ..	56,000	51,600	72,000	68,400	1,20,000	4.18	..	..	..	5,01,600
9th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
10th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
11th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
12th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
13th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
14th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600
15th ..	56,000	51,600	72,000	68,400	1,20,000	..	..	..	..	5,01,600

Columns 2 & 3. Areas for irrigation in first two years will be *khari* only, because link will be ready in advance of Triumui and water will be spare in summer only.

Columns 3 & 5. Failed area in summer 8% approximate and in winter 5%.

Columns 7 & 8 summer water-rate Rs. 4.42/- per acre page 128 S. V. P. Completion Report, 1935.
.. 4.18 (1.3 x 4.0)

APPENDIX E-V, STATEMENT III
MONTGOMERY—PAKPATTAN LINK.
SALES AND GRANTS OF CROWN WASTE ON PAKPATTAN PERENNIAL CANAL
 (as amended by Financial Commissioner, Development).

YEAR.	Total Crown waste.	Sales to capitalists	Land in exchange as compensation.	Grants on peasant terms.	Free grants for farms.	Mandis.	Temporary leases.	Total columns 3, 4, 6, 7 and 8.
1	2	3	4	5	6	7	8	9
	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.	Acrea.
4th	867,771	17,275	18,500	302,040	18,058	4,480	230,000	591,262
5th	"	27,275	18,500	302,040	18,958	4,480	225,225	590,487
6th	"	37,275	18,500	302,040	18,958	4,480	216,225	596,487
7th	"	47,275	18,500	302,040	18,958	4,480	205,225	590,487
8th	"	57,275	18,500	302,040	18,958	4,480	195,225	596,487
9th	"	67,275	18,500	302,040	18,958	4,480	185,225	596,487
10th	"	77,275	18,500	302,040	18,958	4,480	175,225	590,487
11th	"	87,275	18,500	302,040	18,058	4,480	170,725	601,987
12th	"	97,275	18,500	302,040	18,958	4,480	165,725	606,987
13th	"	107,275	18,500	302,040	18,958	4,480	161,725	612,987
14th	"	117,275	18,500	302,040	18,958	4,480	161,725	622,987
15th	"	127,275	18,500	302,040	18,958	4,480	162,725	633,987

Column 3. The area taken here is that for 1934-35, sales of land having been stopped because of the expected increase in irrigation and future rise in prices. In the S. V. P. Completion Report, 1935, we have taken 10,000 acres sale per year from 1938-39 and it is not proposed to alter this.

APPENDIX E-V, STATEMENT IV
MONTGOMERY—PAKPATTAN LINK
STATEMENT SHOWING INDIRECT RECEIPTS

YEAR.	Annual total assessed irrigation.	Land revenue rate per acre.	Land revenue.	Area of temporary leases.	Increased rent per acre.	Rent from temporary leases.	Area for sale to capitalists up to the current year.	Increased rate per acre.	Capital value.	Interest @ 6 %.	Total indirect receipts. (Cols. 4 + 7 + 11.)
1	2	3	4	5	6	7	8	9	10	11	12
	Acrea.	Rs.	Rs.	Acrea.	Rs.	Rs.	Acrea.	Rs.	Rs.	Rs.	Rs.
4th	18,000	3/8/-	63,000	230,000	2	4,60,000	"	50	"	"	5,23,000
5th	36,000	"	1,26,000	225,225	2	4,50,450	10,000	50	5,00,000	7,500	5,97,950
6th	67,500	"	2,29,250	215,225	2	4,30,450	20,000	50	10,00,000	37,500	6,07,200
7th	93,500	"	3,27,250	205,225	2	4,10,450	30,000	50	15,00,000	67,500	8,05,200
8th	120,000	"	4,20,000	195,225	2	3,90,450	40,000	50	20,00,000	97,500	9,07,950
9th	127,000	"	4,27,000	185,225	2	3,70,450	50,000	50	25,00,000	1,27,500	9,17,950
10th	120,000	"	4,20,000	175,225	2	3,50,450	60,000	50	30,00,000	1,57,500	9,27,950
11th	120,000	"	4,20,000	170,725	2	3,41,450	70,000	50	35,00,000	1,87,500	9,48,050
12th	120,000	"	4,20,000	165,725	2	3,31,450	80,000	50	40,00,000	2,17,500	9,68,950
13th	120,000	"	4,20,000	161,725	2	3,23,450	90,000	50	45,00,000	2,47,500	9,99,950
14th	120,000	"	4,20,000	161,725	2	3,23,450	100,000	50	50,00,000	2,77,500	10,20,950
15th	120,000	"	4,20,000	162,725	2	3,25,450	110,000	50	55,00,000	3,07,500	10,52,950

Column 2. Figures are obtained from Statement II, column 6.
 Column 5. Area of temporary leases as per Statement III, column 8.
 Column 8. Areas taken from Statement III, column 3, after deducting 17,275 acres, already sold up to 1938-39.
 Column 11. Interest has been calculated at the rate of 6% on the proceeds of land sold in previous years plus 6% for 3 months only on the proceeds of land sold in the current year.

APPENDIX E-V, STATEMENT V

MONTGOMERY—PAKPATTAN LINK

STATEMENT SHOWING GROWTH OF IRRIGATION AND GROSS REVENUE RECEIPTS

YEAR.			Area assessed in acres.	Direct receipts.	Indirect revenue.	Gross revenue.
1			2	3	4	5
			acres	Rs.	Rs.	Rs.
4th	..	..	18,000	79,500	5,23,000	6,02,500
5th	..	..	30,000	1,59,120	5,83,950	7,43,070
6th	..	..	65,500	2,77,540	6,97,200	9,74,740
7th	..	..	93,500	3,93,320	8,05,200	11,98,520
8th	..	..	1,20,000	5,01,600	9,07,950	14,09,550
9th	..	..	1,20,000	5,01,600	9,17,950	14,19,550
10th	..	..	1,20,000	5,01,600	9,27,950	14,29,550
11th	..	..	1,20,000	5,01,600	9,48,950	14,50,550
12th	..	..	1,20,000	5,01,600	9,68,950	14,70,550
13th	..	..	1,20,000	5,01,600	9,90,950	14,92,550
14th	..	..	1,20,000	5,01,600	10,20,950	15,22,550
15th	..	..	1,20,000	5,01,600	10,52,950	15,54,550

Col: 2. Area irrigated is 1,23,000 acres from which 8% failed area has been deducted for summer and 5% for winter. Obtained from Statement II col. 3.

Col: 3. Rates for direct receipts are the same as taken in S. V. P. Completion Report and are actuals in force at present. Figures obtained from Statement II, column 11.

Col: 4. Figures obtained from Statement IV, column 12.

Col: 5. Column 3 + column 4.

APPENDIX E-VI

PROBABLE ADDITIONAL REVENUE DUE TO THE BURALA BRANCH
EXTENSION BEING CONVERTED INTO A PERENNIAL CHANNEL

Note, dated the 1st July 1935, by Mr. Kanwar Sain, I.S.E., Executive
Engineer on Special Duty.

1. The areas at present included in the non-perennial irrigation scheme are as follows:—

Proprietary	..	..	56,113 acres.
Crown waste area	..	..	44,500 „
Total	..	..	100,613 „

Of the Crown waste area 22,250 acres have been given to or are reserved for the local inhabitants. In the forecast, no credit is taken for any increase of revenue from this area, but Government should be able to get some increase. If the people are not agreeable to any increase in rates of *malikana* and land revenue, there would be no obligation to give perennial irrigation to this area. The total net allotable area of Crown waste land is 67,157 acres. Of this, 22,657 acres could not be brought into the non-perennial scheme, but can now be dealt with when Burala Branch is made perennial. Hence the Haveli project should take credit for the whole area of 22,657 acres.

Of the original 44,500 acres, an area of 22,250 acres was reserved for sale to capitalists. Of the 22,657 acres new area, it is proposed to reserve 12,000 acres for sale to capitalists and 10,657 acres for peasant grants, etc. This proportion is the same as has been approved for the Sutlej Valley project perennial areas. The areas available for sale to capitalists are, therefore, 22,250 acres plus 12,000 acres.

For the new area we may take a price of Rs. 250 per acre, the same as allowed for Crown waste on the Sutlej Valley project Pakpattan perennial canal. We may assume that the non-perennial price of the 22,250 acres is as a maximum Rs. 150 per acre which will leave a credit of Rs. 100 per acre for the Haveli. The result is then as below:—

	Rs.
22,250 acres @ Rs. 100 per acre ..	22,25,000
12,000 acres @ Rs. 250 per acre ..	30,00,000

The composite rate of these two items comes to Rs. 150 per acre.*

*A composite rate of Rs. 225/- per acre is approved by Financial Commissioner, Development.
J.D.H. BEURON.
31-7-35.

Peasant grants.

2. In the Sutlej Valley Project Completion Report, Financial Forecast, page 118, rate proposed for *malikana* is Rs. 3 per acre of allotted area for the first ten years and instalments for the purchase of proprietary rights Rs. 5-8-0 per acre up to the 40th year for the succeeding years. As this financial forecast is for ten years only, we are concerned with Rs. 3 per acre. In the financial forecast development of irrigation Statement I†, it is assumed that the area of 10,657 acres will be allotted in five years.

† Page 166.

‡ Financial Commissioner, Development, says this reservation of 3,000 acres is unnecessary.
J.D.H. BEURON.
31-7-35.

3. We have assumed the sale of 2,000 acres per annum to capitalists. In ten years this comes to 20,000 acres as against a total of 34,250 acres available, so that our forecast does not get the full credit for the total area available. We have allowed 3,000‡ acres for land given in exchange, free grant for farms and for *mandis*. This grant of 3,000 acres comes out of the balance of area for sale to capitalists, and is not included in the forecast.

The favour of approval to Statement I attached, after making such alterations as may seem desirable, is requested at the earliest convenience.

4. Areas of irrigation in Crown waste and proprietary areas. Vide Appendix D-III, the probable area of irrigation in summer will be 25,040 acres and that in winter 38,200 acres. Total annual irrigation comes to 63,240 acres.

The intensities of irrigation on the proprietary and Crown waste areas are proposed to be 10 and 60 per cent. of gross area, respectively. Proprietary gross area is 56,113 acres. Proprietary area of annual irrigation will be 40 per cent. of 56,113 = 22,445 acres.

Crown waste area—

Already allotted or reserved for local's	..	..	= 22,250 acres.
Reserved for capitalists	..	..	= 31,250 „
Land for compensation, <i>mandis</i> , etc.	..	..	= 3,000 „
Peasant grants	..	..	= 10,657 „
Total	..	..	= 67,157 „
Intensity @ 60 per cent.	..	..	= 40,294 „
Total area to be irrigated annually	..	..	= 62,739 „

against the figure of 63,240 acres, which can be obtained on the water available as shown above.

The summer to winter crop ratio will be 1 to $1\frac{1}{2}$.

The summer irrigation in proprietary area distributed at 40 per cent. intensity and 1 to $1\frac{1}{2}$ summer to winter crop ratio will be 9,000 acres.
Similarly summer irrigation in Crown waste area will be 16,040 „

	Total	..	25,040	„
Winter irrigation in proprietary area will be	..	13,800	„	
In Crown waste area	..	24,400	„	
	Total	..	38,200	„

which agrees with the probable irrigation based on actual water supplies.

Land revenue rates.

5. The present land revenue rate on the Burala Branch Extension is Rs. 1-4-0 per matured acre for proprietary and Crown waste. On the Sutlej Valley Project Pakpattan canal the rate is Rs. 3-8-0 per matured acre for Crown waste perennial and Rs. 2-8-0 for proprietary perennial. As the intensity of perennial irrigation in the Crown land here will be the same as on the Sutlej Valley project, there appears to be no reason why the land revenue rates for Crown waste* should not be put up to Rs. 3-8-0, giving an increase of Rs. 2-4-0 per acre matured. In the proprietary area, intensity of perennial irrigation allowed is only 40 per cent. as against 60 per cent. on the Sutlej Valley project. Hence we would not be justified in taking more than Rs. 1-12-0 an acre which is equivalent to an increase of 0-8-0 per acre matured.†

*Land revenue rate accepted by Financial Commissioner, Development is Rs. 3/-.
J.D.H. BEDFORD.
31-7-35.

†Rs. 1/12/- accepted by Financial Commissioner, Development.
J.D.H. BEDFORD.
31-7-35.

Rates for temporary cultivation.

6. ‡We may take an increase of Rs. 3 per acre of allotted area in the rate for temporary cultivation for perennial over the non-perennial conditions, and a rate of Rs. 8 per acre allotted for the additional areas:—

22,400 acres @ Rs. 3 per acre	Composite rate Rs. 4-12-0 per allotted acre.
12,000 acres @ Rs. 8 per acre	

‡Proposals accepted by Financial Commissioner, Development.
J.D.H. BEDFORD.
31-7-35.

7. Sanction is requested to the above land revenue rates and rates for temporary cultivation after necessary alterations.

Water-rates.

8. The statement II*, attached shows that the present summer irrigation on the non-perennial Burala Branch is nearly equal to the proposed for the perennial. We would, therefore, not be justified in taking any increase on summer irrigation.

The same statement II shows the area of winter first waterings on the Burala Branch Extension. The maximum done so far is 7,499 acres giving a return of Rs. 22,041. For purposes of this forecast we will assume that the money return will go up to Rs. 36,000. The forecast for winter irrigation is 38,200 acres at Rs. 4/-Rs. 1,52,800. From this must be deducted Rs. 36,000 for water-rate under non-perennial conditions, giving a net increase of Rs. 1,16,800 per annum.

*This is the average water-rate per acre of winter irrigation on the old Burala Branch for the last five years, on the revised schedule sanctioned in 1933 as per statement III, page 167.
J.D.H. BEDFORD.
31-7-35.

9. The favour of a very early reply to the proposals made herein is requested so that the details of the financial forecast may be worked out by the end of July as desired by the Chief Engineer, Construction.

KANWAR SINGH—1-7-35,
Executive Engineer on Special Duty.

Note, dated the 1st July 1935, by Mr. J. D. H. Bedford, I.S.E. Chief Engineer, Construction Administration, Irrigation Works, Punjab.

The proposals are summarised below:—

Additional Crown waste area to come under cultivation 22,657 acres, of which 12,000 acres is reserved for sale to capitalists and 10,657 acres for peasant grants. Rate allowed for sale to capitalists Rs. 250 per acre.

Of Crown waste land under non-perennial development, 22,250 acres is reserved for sale to capitalists; for this Rs. 100 per acre increase is taken. Composite rate of two classes @ Rs. 250 and 100 per acre comes to Rs. 150 per acre. Area assumed to be sold in ten years is 20,000 acres.

20,000 acres @ 150 = Rs. 30,00,000.

Composite rate creditable to Haveli for temporary cultivation is Rs. 4-12-0 per acre. Statement I attached shows proposed areas of temporary cultivation year by year.

Rs. 4-12-0 approved by Financial Commissioner, Development.
J.D.H. BEDFORD.
31-7-35.

Proposed annual perennial irrigation is 63,240 acres. Water-rate in winter to be the same as existing at present on Burala Branch, i.e., Rs. 4 per acre.

For summer, no increase in irrigation is claimed, hence water-rates not required.

Rs. 3/- and Rs. 1/12
per acre approved by
Financial Commission.
J.D.H. BEDFORD,
31-7-35.

APP. E-IV.

The same rates for land revenue on Crown waste areas, as are in existence on Sutlej Valley project, are suggested, i.e., 3-8-0 per acre matured. For proprietary areas Sutlej Valley project rates are 2-8-0, rate now suggested is Rs. 1-12-0 as intensity of irrigation will be 40 per cent. against 60 per cent. on Sutlej Valley canal.

J. D. H. BEDFORD—1-7-35,
Chief Engineer, Construction.

To S. S. F. C. D.

Note, dated the 11th July, 1935, by Mr. H. D. Bhanot, I. C. S., Senior
Secretary to the Financial Commissioner, Development.

*
Not printed.

The existing colonization scheme of the non-perennial Burala Branch Extension is given in Mr. Bourne's letter No. 2281-C, dated the 25th May 1932.* Its paragraph 2 shows that the proprietary area is approximately 58,000 acres. According to Chief Engineer, Irrigation, it is 56,113 acres. I am told by the Canal Officer on special duty that Chief Engineer obtained his figures from Superintending Engineer, Lower Chenab canal. Chief Engineer's figures may be accepted, because the figures for the proprietary area in Mr. Bourne's letter, referred to above, are only approximate.

The Crown waste area within the irrigation boundary of the Burala Branch Extension according to Mr. Bourne's letter, dated 25th May, 1932 is 93,000 acres. According to Extra Assistant Colonization Officer in charge of Lower Chenab Canal Extensions, after excluding uncommanded, *ghair munh-in*, *abadis* and *charagh*, etc., the net allotable Crown waste area is 67,157 acres.

For the colonization of this Crown waste area Chief Engineer's proposal in his foregoing note is—

		Acres.
Already allotted to local peasant grantees ..	..	22,250
Further allotment as grants ..	..	10,657
To be reserved for auction ..	..	34,250
Total ..	..	67,157

† Not printed.

Extra Assistant Colonization Officer has submitted two alternative proposals in paragraphs 8 and 9 of his note,† viz. :—

		Acres.
(1) Already allotted to local peasant grantees ..	..	22,250
(2) To be reserved for auction ..	..	44,907
Total ..	..	67,157
(3) Already allotted to local peasant grantees ..	..	22,250
Further allotment as grants ..	..	17,800
To be reserved for auction ..	..	27,107
Total ..	..	67,157

I realise the importance of peasant grants; but we have no commitments at present on the Lower Chenab Canal Extensions and in order to make the Haveli project pay, Chief Engineer's scheme for the disposal of the Crown waste area appears to be the most suitable.

It will be observed that we have at our disposal a net Crown waste area of 44,907 acres. If more area is to be reserved for grants, I would not suggest going above one-third of the area available. This will leave two-thirds for sale as follows:—

		Acres.
Already allotted to local peasant grantees ..	..	22,250
Further allotment as grants ..	..	15,000
To be reserved for auction ..	..	29,907
Total ..	..	67,157

Either Chief Engineer's proposal or my suggestion for the disposal of the Crown waste area may be approved. There is no need for the reservation of 3,000 acres, as suggested by Executive Engineer on Special Duty in paragraph 3† of his note.

4. It has now to be seen for what area and on what account the Haveli project should take credit owing to the Burala Branch Extension becoming a perennial channel. The existing

colonization scheme of the non-perennial area according to Mr. Bourne's letter, dated the 25th May, 1932 is:—

		<i>Acres.</i>
Grants to local peasants	..	22,250
To be leased for temporary cultivation	..	22,250
Total	..	44,500

Thus the new area to be brought under irrigation is $(67,157 - 44,500) = 22,657$ acres.

Chief Engineer appears to be under the impression that 22,250 acres, which were to be leased for temporary cultivation, have been reserved for auction. This is not correct. † Not printed. Please see paragraph 9 of Mr. Calvert's note dated 8th March, 1932, where he says "I think 800 rectangles will deal with all local claims to consideration and the other 800 will be in our pocket available for distribution later on." Paragraphs 8 and 9 of Mr. Bourne's letter, dated the 25th May, 1932 will show that only 4 estates were to be reserved for auction. The area of these estates is 5,900 acres according to the Extra Assistant Colonization Officer. Therefore, out of 22,250 acres, which were to be leased for temporary cultivation, only 5,900 acres have been specifically reserved for sale by auction.

The Canal Officer on Special Duty further says in paragraph 1 of his note, that he has not taken into account any increase of revenue from 22,250 acres already allotted to peasant grantees and from the proprietary area. I do not agree with this. There will be an increase in rates owing to the conversion of non-perennial into perennial irrigation and I see no reason why the Haveli project should not get credit for this increase. The increase will, of course, take effect with the consent of the grantees and proprietors; and those, who do not agree to the increased rates, will not get perennial irrigation. It may, therefore, be presumed that every one will agree to the increased rates, as happened in the Montgomery district portion of the Nili Bar colony. † Page 160.

The credit to be given to the Haveli project thus is as follows:—

- (1) Entire credit for the new area coming under irrigation, i.e., 22,657 acres.
- (2) Entire sale-proceeds of the land to be sold by auction except that for 5,900 acres; credit will be taken for the increase in the sale-proceeds owing to the conversion of non-perennial irrigation into perennial.
- (3) The increase in land revenue, *malikana*, water-rates and purchase price payable by the grantees on the area already allotted to local peasants, i.e., 22,500 acres.
- (4) The increase in water-rates and temporary cultivation rent on the area already included in the non-perennial colonization scheme and ear-marked for temporary cultivation, i.e., 22,250 acres.
- (5) The increase in land revenue and water-rates on the proprietary area already getting non-perennial irrigation, i.e., 56,113 acres.

Price of land to be sold by auction.

5. Chief Engineer has assumed the average price of Rs. 250 per acre. This may be approved. He assumes the price of non-perennial area to be Rs. 150 per acre; but I do not see why it should be more than half of the price of perennial area. The difference between the sale price of perennial and non-perennial area will be Rs. 125 per acre. According to Chief Engineer's scheme for the disposal of Crown waste area, vide paragraph 3 above, the result will be:—

28,350 acres @ Rs. 250 per acre	Rs. 70,87,500
5,900 acres @ Rs. 125 per acre	Rs. 7,37,500
34,250 acres @ Rs. 228-8-0 per acre	Rs. 78,25,000

compared with Rs. 52,24,000 calculated by the Chief Engineer. The composite rate, for financial forecast purposes, may be taken at Rs. 225 per acre.

According to my scheme the result will be:—

	<i>Rs.</i>
24,007 acres @ Rs. 250 per acre	.. 60,01,750
5,900 acres @ Rs. 125 per acre	.. 7,37,500
29,907 acres @ Rs. 225-6-0 per acre	.. 67,39,250

The composite rate may remain Rs. 225 per acre.

The sales may proceed at the rate of 2,000 acres per year.

Malikana on peasant grants.

6. The present rate of *malikana* paid by peasant grantees on Burala Branch Extension is Rs. 1-8 per acre matured, vide clause 17 of the statement of conditions. Chief Engineer wishes to lay the same rate as in the Nili Bar colony, i.e., Rs. *3 per acre allotted per annum. This rate exists in the Nili Bar colony in name only. *Malikana* at this rate has not been recovered since *rabi* 1931. Instead of Rs. 3 per acre allotted per annum we are recovering Rs. 1/8- per acre matured. Therefore, I would only double the rate of *malikana* on the Burala Branch Extension and make it Rs. 3 per acre matured, when it becomes perennial.

*In the Haveli Crown waste area orders are for Rs. 2/- per acre allotted perennial. The order on this is for Rs. 3/- per acre matured. Rs. 3/- per acre matured is not materially different from 2/- per acre, allotted. Hence for uniformity we are taking Rs. 2/- per acre allotted.
J.D.H. BEDFORD,
30-7-35.

Allocation to peasant grantees may be completed within two years of the date on which perennial irrigation starts.

Purchase price for peasant grants.

7. It is at present Rs. 50/- per acre rising to Rs. 120/- in 40 years. It will become Rs. 100/- per acre rising to Rs. 240/- in 40 years. The average amount of each instalment will be Rs. 5/8/- as in the Sutlej Valley Project Completion Report. Haveli will take credit for Rs. 2/4/- per acre for the area already allotted to peasants and for Rs. 5/8/- per acre for the new area to be allotted to peasants from the 11th to the 40th year, when *malikana* will cease and purchase price will be paid; but in paragraph 2 of his note, Canal Officer on Special Duty says that he is preparing the financial forecast for ten years only. The payment of the instalments of purchase price will not, therefore, be taken into consideration in preparing the present financial forecast of the Haveli project.

In first 10 years' forecast we take *malikana* only; as we are being given credit for conversion of areas from non-perennial to perennial. We can take credit for difference in *malikana* only on allotted areas, viz.: Rs. 2—Rs. 1=1/- per acre.

Irrigation intensity.

8. Please see paragraph 4 of Canal Officer on Special Duty's foregoing note. The figures of area will be changed according to orders passed on paragraph 3 of this note; but I am not very much in favour of having different intensities for the proprietary and Crown waste areas. When Burala Branch was made a non-perennial channel, a similar question was considered. It was proposed to give 13½ per cent. irrigation to proprietary area and 20 per cent. to Crown waste. Please see paragraph 3 of Mr. Calvert's note, dated 8th March, 1932. It was decided to give 25 per cent. irrigation to both proprietary and Crown waste area. According to the water available, it is proposed to give 40 per cent. to proprietary and 60 per cent. to Crown waste area. This is a matter entirely for the Irrigation Branch and I am unable to comment on it usefully. Therefore, all I can suggest is that Chief Engineer's recommendation may be approved.

J.D.H. BEDFORD,
30-7-35.

Land revenue rates.

9. The present land revenue rate is Rs. 1-1-0 per matured acre for both proprietary and Crown waste area. Chief Engineer proposes to raise the rate in the Crown waste area to the same as in the Nili Bar colony, i.e., Rs. 3-8-0 per matured acre. For the proprietary area he proposes Rs. 1-12-0 per matured acre in view of the fact that it will get 40 per cent. irrigation.

Rs. 3 per acre sanctioned by Financial Commissioner, Development.
J.D.H. BEDFORD,
30-7-35.

On the Pir Mahal Extension the land revenue rate for the Crown waste area is Rs. 3 per matured acre. On the Khikhi Extension it is Rs. 2-8-0 per matured acre. Extra Assistant Colonization Officer suggests Rs. 2-8-0 per matured acre for the Burala Branch Extension. I am inclined to agree with him. If this is considered low, I would not go above Rs. 3 per matured acre, which is the rate in the Pir Mahal Extension.

For the proprietary area Chief Engineer is right that with 40 per cent. irrigation the land revenue rate may be raised from Rs. 1-1-0 to Rs. 1-12-0 per matured acre.

Rent from temporary cultivation.

No change ride (2)
page 165.
J.D.H. BEDFORD,
30-7-35.

10. I agree with what Chief Engineer says in paragraph 6 of his foregoing note. The figures of area are subject to alteration consequent on the orders passed on paragraph 3 of this note.

Water-rates.

Same water-rates approved for Crown waste and proprietary areas by Financial Commissioner, Development.
J.D.H. BEDFORD,
30-7-35.

11. Please see paragraph 8 of Canal Officer on Special Duty's note. The average proposed water-rate is Rs. 4 per matured acre, based on the average of the old Burala Branch. This means that when the Burala Branch Extension becomes perennial, the water-rates will be the same as in the perennial area of the rest of the Province. There can be no objection to levying these rates on the Crown waste area which is to get 60 per cent. irrigation; but for the proprietary area getting 40 per cent. irrigation, the rates will prove high. It is true that the rate is a charge for water supplied and those who get 40 per cent. irrigation will pay on 40 acres; but the paying capacity of those who mature 40 per cent. is much less than those who mature 60 per cent. I would, therefore, suggest reduction in the water-rates for the proprietary area.

H. D. BHANGT—11-7-35.

To F. C., D.

S. S. F. C. D.

Note, dated the 19th July 1935, by Mr. B. H. Dotson, C.B.E., I.C.S., Financial Commissioner, Development.

This is a reference from Irrigation Branch regarding credit to be given to the Haveli project for the conversion of the Burala Branch Extension into a perennial channel.

Not printed.

Extra Assistant Colonization Officer, Lyallpur, has submitted a note* on the same subject, which is somewhat premature. It amounts in fact to a colonization scheme for this area in great detail. As a matter of fact, colonization of this area is a long way off and there are numerous obstacles to be overcome, quite apart from irrigation question, such as the opposition of cultivators on the upper reaches of the Burala Branch. However, Extra

APP. E-VI

Assistant Colonisation Officer's reference, though not at the moment very relevant, contains interesting details and will be useful later on. Meanwhile, Commissioner may be told at once that he need not comment on it, as he may already be putting himself to a great deal of unnecessary trouble.

Returning now to the Irrigation Branch reference, I may first draw attention to the Senior Secretary's note of 11th July, which is as usual thoroughly comprehensive. Water is apparently to be found for this extension by releasing Triple Canal project supplies which would otherwise go to the Lower Bari Doab. These supplies will be available after the construction of the Haveli project by Ravi water which will be held up at Balloki and not sent on as at present, to Sidhnai. The whole discussion is academic, our object being merely to indicate to the Irrigation Branch on this reference what income they can reasonably count on, if this part of the project matures.

Water is found by releasing Ravi supplies now reserved for Sidhnai canals.
J.D.H. BEDFORD—30-7-35.

I would accordingly reply to the reference as proposed by the Senior Secretary, subject to the following observations.—

- (1) Para. 2.—The proprietary area may be taken as 56,113 acres.
- (2) Para. 3.—We do not, of course, know how Government will decide to deal with the allotable Crown waste of 67,157 acres, nor is it necessary to go into the matter now, but of the four estimates put forward I would accept that of Chief Engineer for the purposes of the present reference.
- (3) The total credits to be given to the Haveli project appear to me to be correctly stated at the end of the Senior Secretary's note, para. 4 (page 163).
- (4) Para. 5.—The proceeds of 34,250 acres to be sold by auction may be reckoned at Rs. 78,25,000.
- (5) Paras. 6-8.—I agree with the Senior Secretary.
- (6) Para. 9.—*Land revenue rates.* Burala lands are believed to be the best of the three extensions. We should, therefore, be able to assess at Rs. 3 per matured acre. On proprietary lands, I agree in the proposed rise from Rs. 1-4-0 to Rs. 1-12-0 per matured acre.
- (7) Paras. 10 and 11.—I agree as to temporary cultivation, but there is no need to differentiate in the matter of water-rates between proprietary and Crown waste areas, as both will pay the same. We are not now concerned with the relative wealth of different cultivators.

B. H. DOBSON—19-7-35.

F. C. D.

MUZAFFAR KHAN—22-7-35.

H. M. R.

I agree for the purposes of a provisional estimate.

H. W. EMLERSON—24-7-35.

H. E.

Will Chief Engineer, Irrigation Branch (Construction), please see the accompanying notes and orders passed on them by His Excellency. In order to avoid delay, I forward the whole case. Will Chief Engineer please take copies of relevant notes and orders and return the case.

H. D. BHANOT—27-7-35.

S. S. F. C. D.

To C. E. I. B. (C).

(U. O. No. 301-C(S), dated 29th July 1935.)

Returned after keeping a copy. Reference is invited to the remarks made in the margin on paras 6 and 7 of the Senior Secretary's note. The forecast figures have been altered in accordance with these remarks and other orders as contained in Financial Commissioner's note.

J. D. H. BEDFORD—31-7-35.

C. E. C.

S. S. F. C. D.

(U. O. No. 620-S/Con., dated 31st July 1935.)

F. C. D. might see. I have no objection to C. E.'s marginal remarks on paras. 6 and 7.

H. D. BHANOT—31-7-35.

S. S. F. C. D.

B. H. DOBSON—1-8-35.

F. C. D.

Statement IV shows the direct receipts from additional areas which will be irrigated. Statement V shows total indirect receipts from all sources, and is based on the rates approved by Special Commissioner, Development.

Statement VI shows the total gross revenue from Burala Branch Extension being converted into a perennial channel.

KANWAR SAIN—1-8-35.

Executive Engineer on Special Duty.

APPENDIX E-VI, STATEMENT I.

STATEMENT SHOWING SALES AND GRANTS OF CROWN WASTE LAND
ON THE BURALA BRANCH EXTENSION.

(EXCLUDING 22,210 ACRES ALREADY GIVEN TO LOCALS).

Up to the end of.	Total allotable Crown waste. (Acres.)	Sale.	Grant on peasant terms.	Land in exchange.	Free grants for farmers.	Mandis.	Temporary leases.	Total available for irrigation cols 3, 4, 5, 6, 7 and 8
1	2	3	4	5	6	7	8	9
6th Year ..	67,157	Acres. 2,000	Acres. 2,000	Total of cols 5, 6 and 7 has been taken as 2,250 acres. If this reservation is considered un- necessary, this area may be considered as left over from temporary cultivation.			Acres. 0,000	Acres 10,000
7th ..		4,000	4,000				0,000	17,000
8th ..		0,000	0,000				12,000	24,000
9th ..		8,000	8,000				16,000	32,000
10th ..		10,000	10,057				20,000	40,057
11th ..		12,000	10,057				20,000	44,907
12th ..		14,000	10,057				18,000	44,907
13th ..		16,000	10,057				16,000	44,907
14th ..		18,000	10,057				14,000	44,907
15th ..		20,000	10,057				12,000	44,907

APPENDIX E-VI, STATEMENT II.

STATEMENT SHOWING THE AREA ASSESSED IN *KHARIF* AND *RABI* AND
THE WATER-RATES ON THE BURALA BRANCH EXTENSION FOR THE
LAST 5 YEARS.

Year.	SUMMER CROPS.			WINTER CROPS.	
	Area assessed.	Abiana calculated at revised rates sanctioned in 1933.	Average water-rate per acre.	Area assessed.	Abiana calculated at revised rates sanctioned in 1933.
1	2	3	4	5	6
	Acres.	Rs.	Rs. As.	Acres.	Rs.
1930-31	9,315	40,941	4 6	2,135	7 119
1931-32	10,151	45,537	4 6	3,991	12,403
1932-33	15,503	67,616	4 6	7,499	22,044
1933-34	20,217	80,384	4 7	7,101	20,039
1934-35	21,124	1,13,575	4 11	5,158	15,090

APPENDIX E-VI, STATEMENT III

STATEMENT SHOWING THE AVERAGE WATER-RATE PER ACRE ON THE OLD BURLA BRANCH DURING THE LAST FIVE YEARS, CALCULATED AT THE REVISED RATES SANCTIONED IN 1933.

Year.	Area assessed.	Water-rate.	Average water-rate per acre.
	Acres.	Rs.	Rs.
Rabi 1930-31	2,20,129	8,70,773	4
Rabi 1931-32	2,14,794	8,47,183	4
Rabi 1932-33	1,79,977	7,27,480	4
Rabi 1933-34	2,19,630	8,59,546	4
Rabi 1934-35	1,96,571	7,71,720	4

APPENDIX E-VI, STATEMENT IV.

BURLA BRANCH EXTENSION.

STATEMENT SHOWING DIRECT RECEIPTS.

YEAR.	SUMMER CROPS.		WINTER CROPS.				Total Crown waste assessed.	Total proprietary assessed.	Total assessed area.	Water-rate per acre.	Direct receipts.	Deduct present abiana for 1st waterings.	Net water-rates.
	Area irrigated.	Area assessed.	Crown waste area irrigated.	Crown waste area assessed.	Proprietary area irrigated.	Proprietary area assessed.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Rs.	Rs.	Rs.	Rs.
6th	12,773	12,131	7,227	6,861	12,131	6,861	18,993	4/-	75,080	36,000	39,080
7th	10,160	18,202	10,810	10,208	18,202	10,208	28,500	..	1,14,000	36,000	78,000
8th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
9th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
10th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
11th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
12th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
13th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
14th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160
15th	24,400	23,180	13,800	13,110	23,180	13,110	36,290	..	1,45,160	36,000	1,09,160

APPENDIX E-VI, STATEMENT V.
BURALA BRANCH EXTENSION.
STATEMENT SHOWING INDIRECT RECEIPTS.

(contd. to next page)

Year.	SUMMER CROPS ASSESSED IRRIGATION.		LAND REVENUE RATES PER ACRE.		LAND REVENUE ON WINTER CROPS IRRIGATION.		PRESENT IRRIGATION.				DIFFERENCE IN LAND REVENUE RATES PER ACRE.			PRESENT LAND REVENUE RATES PER ACRE.				
	Crown waste.	Proprietary.	On proprietary.	On Crown waste.	Crown waste.	Proprietary.	Summer crops.		Winter crops.		Summer crops.		Crown waste.	Proprietary.	Crown waste.	Proprietary.		
							Crown waste.	Proprietary.	Crown waste.	Proprietary.	Crown waste.	Proprietary.						
1	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
6th	12,134	9,861	1 12	3	36,102	12,007	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
7th	18,202	10,298	1 12	3	54,096	18,021	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
8th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
9th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
10th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
11th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
12th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
13th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
14th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4
15th	23,180	13,110	1 12	3	69,540	22,912	16,010	9,000	7,090	4,310	15,238	8,550	7,306	4,095	1 12	0 8	1 4	1 4

Cols. 2 & 3 obtained from cols. 8 & 9, Statement I.

APPENDIX E-VI. STATEMENT V—concluded.

BURALA BRANCH EXTENSION

STATEMENT SHOWING INDIRECT RECEIPTS

Year.	Increase in Land Revenue Summer.		Deduction in Land Revenue.	Total Increase in Land Revenue.	Area of temporary lease.	Composite increase in rent per acre.		Rent from temporary lease.	Area on peasant terms.		Increase in <i>Mullana</i> per acre.	Revenue from lands on peasant terms.		Area sold up to the end of the year.	Composite rate of increase per acre.	Capital returns.		Interest @ 6%.	Total indirect receipts.
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
1																			
6th	26,667	4,275	14,250	65,101	6,000	4.75	38,500	2,000	2	4,000	22,250	1	22,250	2,000	225	4,50,000	6,750	1,20,601	
7th	26,667	4,275	14,250	80,319	9,000	4.75	12,750	1,000	2	8,000	22,250	1	22,250	4,000	225	9,00,000	33,750	1,96,069	
8th	26,667	4,275	14,250	109,174	12,000	4.75	57,000	6,000	2	12,000	22,250	1	22,250	6,000	225	13,50,000	60,750	2,61,174	
9th	26,667	4,275	14,250	109,174	10,000	4.75	70,000	8,000	2	13,000	22,250	1	22,250	8,000	225	18,00,000	87,750	3,11,174	
10th	26,667	4,275	14,250	109,174	20,000	4.75	95,000	10,657	2	21,314	22,250	1	22,250	10,000	225	22,50,000	1,14,750	3,62,488	
11th	26,667	4,275	14,250	109,174	20,000	4.75	95,000	10,657	2	21,314	22,250	1	22,250	12,000	225	27,00,000	1,41,750	3,89,488	
12th	26,667	4,275	14,250	109,174	18,000	4.75	85,500	10,657	2	21,314	22,250	1	22,250	14,000	225	31,50,000	1,68,750	4,00,988	
13th	26,667	4,275	14,250	109,174	16,000	4.75	78,000	10,657	2	21,314	22,250	1	22,250	16,000	225	36,00,000	1,95,750	4,24,488	
14th	26,667	4,275	14,250	109,174	14,000	4.75	68,500	10,657	2	21,314	22,250	1	22,250	18,000	225	40,50,000	2,22,750	4,41,988	
5th	26,667	4,275	14,250	109,174	12,000	4.75	57,000	10,657	2	21,314	22,250	1	22,250	20,000	225	45,00,000	2,49,750	4,59,488	

Col. 20 is obtained by multiplying the increase in land revenue rate, col. 16 by existing summer crops assessed, i.e., col. 12 for Crown waste areas.

Col. 21 is obtained by multiplying the increase in land revenue rate, col. 17 by existing summer crops assessed, col. 13 for proprietary areas.

Col. 22 is a deduction and is obtained by multiplying the present land revenue rates which are the same for Crown waste and proprietary by the present winter crops assessed, cols. 14 + 15.

Col. 23 = col. 6 + col. 7 + col. 20 + col. 21 = col. 22.

Col. 24 is obtained from col. 8, Statement I.

Col. 25 is obtained from col. 4, Statement I.

Col. 26 is obtained from col. 3, Statement I.

Col. 27 = col. 23 + col. 26 + col. 29 + col. 32 + col. 36.

Col. 28 = Interest has been calculated at the rate of 6% on the proceeds of land sold in the current year.

APPENDIX E-VI, STATEMENT VI
BURALA BRANCH EXTENSION
STATEMENT SHOWING GROSS RECEIPTS

Year.	Additional area assessed.	Direct Receipts.	Total Indirect Receipts.	Gross Revenue.
1	2	3	4	5
	acres	Rs.	Rs.	Rs.
6th	18,995	39,980	1,26,601	1,66,581
7th	28,500	78,000	1,96,069	2,74,069
8th	36,290	1,09,160	2,61,174	3,70,334
9th	36,290	1,09,160	3,11,174	4,20,334
10th	36,290	1,09,160	3,62,488	4,71,648
11th	36,290	1,09,160	3,89,488	4,98,648
12th	36,290	1,09,160	4,06,988	5,16,148
13th	36,290	1,09,160	4,24,488	5,33,648
14th	36,290	1,09,160	4,41,988	5,51,148
15th	36,290	1,09,160	4,59,488	5,68,648

Col. 2 is obtained from col. 10 Statement IV.
Col. 3 is obtained from col. 14 Statement IV.
Col. 4 is obtained from col. 37 Statement V.
Col. 5 = col. 3 + col. 4.

PROGRAMME OF CONSTRUCTION AND ENGINEERING ESTABLISHMENT REQUIRED

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APPENDIX F-I

PROGRAMME OF WORKS

I.—Weir Division—Trimmu.

- 1st year. Preliminary operation; survey of bunds and railway and commencement of these works; construction of buildings in progress.
- 2nd year. Ceremony of laying of foundation stone; excavation of founds in left pocket and a few bays of weir.
- 3rd year. Continuation of work on weir.
- 4th year. Continuation of work on weir.
- 5th year. Completion of work in weir. Diversion of river and opening ceremony at Trimmu.

II.—Second Division—Trimmu Headworks.

For 3 years, a second division will be opened to deal with stone, canal railways, plant and protection bunds, etc.

- 2nd year. Completion of railway and of buildings and collection of materials and plant.
- 3rd year. Looking after railway, and arrangements for materials for headworks and construction of marginal bunds.
- 4th year. Looking after railways and arrangements for materials for headworks and completion of marginal bunds.

III.—Right Bank and Shorkot Branch Canals Division.

- 2nd year. Preliminary operations; surveys, estimates and commencement of excavation.
- 3rd year. Continuation of earthwork excavation and collection of materials for masonry works.
- 4th year. Earthwork excavation in full swing and masonry work in progress, and estimates for distributaries under consideration.
- 5th year. Excavation of earthwork completed; masonry works nearly completed; distributary work in full swing and watercourse construction commencing.
- 6th year. Distributaries and watercourse construction complete.

IV.—Sidhni Headworks Division.

- 2nd year. Collection of materials and preliminary work.
- 3rd year. Excavation of founds complete and construction of abutments and piers in progress; head regulators and weir in full progress.
- 4th year. Completion of weir.

V.—Left Bank Canals Division.

- 1st year. Preliminary work, survey of alignment and making of earthwork estimates.
- 2nd year. Collection of materials and excavators, commencement of excavation, burning of bricks on a large scale for core walls and commencement of core wall.
- 3rd year. Earthwork on main canals in full swing, both by excavators and manual labour. Work of core walls in progress—masonry works commenced.
- 4th year. Earthwork and core wall in full swing; masonry work in progress and distributaries under consideration.
- 5th year. Earthwork and core wall and distributary walls in full swing, masonry work nearing completion and watercourse construction commencing.
- 6th year. Earthwork and core wall and masonry works complete; a few odds and ends of distributary and watercourse works incomplete.
- 7th year. Everything complete.

VI.—Non-Perennial Canals Division.

- 2nd year. Preliminary surveys and reorganization of existing canal division and estimating work for connecting links with new Abdul Hakim headworks.
- 3rd year. Excavation of connecting links in full swing, masonry works and extensions of existing channels under consideration.
- 4th year. Excavation of connecting links and masonry works in full swing, distributary remodelling and extensions of distributaries taken up.
- 5th year. Excavation of connecting links and masonry works nearing completion, remodelling work in full swing and water course construction commencing.
- 6th year. Connecting links and masonry works complete, remodelling work and watercourse construction nearing completion.
- 7th year. All complete.

VII.—Perennial Canals Division.

- 2nd year. Preliminary surveys and reorganization of existing canal division and estimating work for connecting links with new Abdul Hakim headworks.
- 3rd year. Excavation of connecting links in full swing, masonry works and extensions of existing channels under consideration.
- 4th year. Excavation of connecting links and masonry works in full swing, distributary remodelling and extensions of distributaries taken up.
- 5th year. Excavation of connecting links and masonry works nearing completion, remodelling work in full swing and watercourse construction commencing.
- 6th year. Connecting links and masonry works complete, remodelling work and watercourse construction nearing completion.
- 7th year. All complete.

STATEMENT SHOWING PROBABLE ENGINEERING ESTABLISHMENT REQUIRED FOR CONSTRUCTION, HAVELI PROJECT

The barrage is an expensive work costing 230 lacs of rupees, more expensive than any other headworks so far built in the Punjab. The construction of such a work has big ramifications. Orders for steelwork, cement and dealers with quarries, railways, etc., will be very heavy in addition to work on protection bunds. If the Executive Engineer in charge of barrage is relieved of all these subsidiary responsibilities, he can devote much more time to supervision. The work of the barrage will be of better quality and will be done quicker. With 2 Executive Engineers it is hoped that the barrage may be completed in 18th year, in which case there will be savings in interest charges to neutralize the cost of the extra division but reduction in expenditure has not been shown for such probable savings.

The Ravi circle will have two Havell project divisions and the Mausi canals division which at present is in the Nili Bar circle of the Sutlej Valley project canals; the Nili Bar circle is at present heavy, but not big enough for two circles. The Ravi circle of the Havell project is on the other hand small, hence the transfer of one division from Nili Bar circle to the Ravi circle. The work of the Ravi circle will consist principally of remodeling of existing channels, hence establishment of the Mullan canals division. When Havell project starts, this division will be absorbed and areas allocated to suit construction requirements.

2. G.2. relevant establishment required after construction is complete.
Temporary increase during construction is 2 Superintending Engineers, 7 Executive Engineers, and 25 Sub-Divisional Officers.
Permanent increase after construction is 1 Superintending Engineer, 3 Executive Engineers, 7 Sub-Divisional Officers.

to suit construction requirements.

APPENDIX F-III, STATEMENT I

STATEMENT SHOWING ESTIMATED COST OF ESTABLISHMENT FOR HAVELI PROJECT
BASED ON ACTUAL REQUIREMENTS:

	Circle offices including Superintending Engineers' pay.	Divisional offices with sub- divisions including Executive Engineers' pay.	Cost of Personal Assistants.		Total.
			P.A. to C.E.	P.A. to D.E.	
	Rs.	Rs.	Rs.	Rs.	Rs.
1st year	$\frac{2 \times 58000}{4} = 29,000$	$\frac{2 \times 120000}{4} = 60,000$	3,950	1,950	94,900
2nd year ..	$2 \times 58000 = 1,16,000$	$6 \times 120000 = 7,20,000$	15,900	7,800	8,59,700
3rd year ..	$2 \times 58000 = 1,16,000$	$6 \times 120000 = 7,20,000$	15,900	7,800	8,59,700
4th year ..	$2 \times 58000 = 1,16,000$	$6 \times 120000 = 7,20,000$	15,900	7,800	8,59,700
5th year ..	$2 \times 58000 = 1,16,000$	$5 \times 120000 = 6,00,000$	15,900	7,800	7,39,700
6th year ..	$2 \times 58000 = 1,16,000$	$5 \times 120000 = 6,00,000$	15,900	7,800	7,39,700
Total for the construc- tion period ..	6,09,000	34,20,000	83,450	40,950	41,53,400

Total Superintending Engineer and Executive for the construction
period, including Personal Assistants to Chief Engineer and Executive
Engineer Rs. 41,53,400

Medical for 6 years 2,20,500

Cost of Chief Engineer for six years 7,40,250

Total .. 51,14,150

Pensionary charges 7 per cent. 3,57,991

Leave in England 2,62,000

Total .. 57,34,141

Add for 2nd Division at Trimmu Headworks for 3 years with medical
staff at Rs. 1,00,000 per year 3,00,000

Total .. 60,34,141

Say .. 60,34,000

Allowance made for establishment in the project estimate on percent-
age basis (as per Statement II) 66,95,000

Balance .. 6,61,000

This balance will suffice for unforeseen items and for any special allowance to the
staff, that may be sanctioned by the Government.

APPENDIX F-III, STATEMENT II

Estimate of establishment costs based on the expenditure estimate of the project:

			Rs.	Rs.
No. 1—Trimmu Headworks:—				
II—(a) Establishment	=	15,59,475
II—(b) Leave Salary	=	1,01,366
II—(c) Pensionary Charges	=	1,16,259
Total ..			=	17,77,100 say 17,77,000
Unit No. 2—Abdul Hakim Headworks:—				
II—(a) Establishment	=	2,64,600
II—(b) Leave Salary	=	17,199
II—(c) Pensionary Charges	=	19,726
Total ..			=	3,01,525 say 3,02,000
Unit No. 3—Left Bank Canals:—				
II—(a) Establishment	=	26,56,680
II—(b) Leave Salary	=	1,72,645
II—(c) Pensionary Charges	=	1,98,011
Total ..			=	30,26,336 say 30,27,000
Unit No. 4—Rangpur Canal:—				
II—(a) Establishment	=	12,20,320
II—(b) Leave Salary	=	79,314
II—(c) Pensionary Charges	=	90,967
Total ..			=	13,90,601 say 13,91,000
Unit No. 5—Montgomery—Pakpattan Link:—				
II—(a) Establishment	=	1,73,520
II—(b) Leave Salary	=	11,279
II—(c) Pensionary Charges	=	12,936
Total ..			=	1,97,735 say 1,98,000
GRAND TOTAL ..			=	66,95,000

In the project estimate, establishment has been calculated on percentage basis as under:—

For headworks	..	..	..	7½ per cent. of Works.
For canals	..	..	..	18 per cent. of Works.
plus allowances for pensionary charges and leave salaries.				

APPENDIX F-III, STATEMENT III

Statement showing probable estimate of cost of rent free accommodation for Trimmu Headworks.

Annual expenditure under IV—Executive—Establishment S. V. P. 1929-30:—

	Rs.
Pay of Officers	6,91,218
Pay of Establishment	13,48,443
Total	20,39,661
No. of Divisions on the S. V. P. in the year 1929-30	25
Therefore expenditure for one Division including Sub-Divisions	
Rs. 20,39,661	81,586
Cost of rent free accommodation for one year will be 10 per cent. of	
Rs. 81,586	8,158
Cost for 6 years	48,948
Say	50,000

This has been shown under V-Receipts on Capital Account Unit No. I.

